THE IRON TRADE REVIEW

VOLUME XXX. CLEVELAND, O. FEBRUARY 18, 1897. CHICAGO, ILL. NUMBER 7

BEST ANTI-FRICTION METAL

For All Machinery Bearings.

MAGNOLIA METAL CO.,

Owners and Sole Manufacturers,

74 Cortlandt St., New York.

CHICAGO: Traders' Building. LONDON: 40 Queen Victoria St., E. C.

MAGNOLIA METAL

Moore's Anti-Friction

DIFFERENTIAL

CHAIN HOIST.

Adjustable Automatic Brake.
Self sustaining at every point.
Highest Efficiency
A New Movement.
A Perpetual Compound Lever.
Powerful, Simple and Durable.
Light, Compact and Strong.

NINE SIZES.

Half Ton to Ten Tons Capacity.

ALSO

HAND POWER CRANES, WINCHES, &c.

Moore Manufacturing Co.,

MILWAUKEE, WIS.

FORSTER, WATERBURY & CO.,

636-638 THE ROOKERY, CHICAGO.

PIG IRON AND COKE.

Agents for Iroquois, Peerless, Sterling Scotch, Northern and Southern Charcoal Iron. MALLEABLE BESSEMER.

DICKMAN & MACKENZIE,

CLEVELAND, 71 Atwater Bldg. CHICAGO, 1224 Rookery Bldg.

Mining properties examined. Ores sampled at mines, furnaces and all lake ports.
General analyses of Ores, Slags, Metals, Fuel Foundry Materials and Products, etc.

CHEMISTS AND ENGINEERS.

CAHALL VERTICAL WATER TUBE BOILERS MANUFACTURED BY THE AULTMAN & TAYLOR MACHINERY CO. MANSFIELD — OHIO. BABCOCK & WILCOX HORIZONTAL

SEND FOR CATALOGUE.

CAHALL SALES DEPARTMENT,

Bank of Commerce Building, PITTSBURG, PA.

145 Taylor Building, New York City, N. Y.
The "Rookery," Chicago, Ill.
71 Perin Building, Cincinnati, O.
10 Peninsular Bank Bldg., Detroit, Mich.
826 Cuyahoga Bldg., Cleveland, O
712 Union St., New Orleans, La.
542 Drexel Bldg., Philadelphia, Pa
1015 Tremont Bldg, Boston.

ENTERPRISE BOILER COMPANY

YOUNGSTOWN, O.

Draught Stacks, Blast Furnaces and Heavy Plate Work a Specialty.

Write for Estimates.

BUFFALO VENTILATING FANS

ELECTRIC, STEAM AND PULLEY TYPES. GREATEST AIR VOLUME, LEAST POWER

BUFFALO FORGE CO. BUFFALO, N.Y. U.S.A.

CASTINGS FROM 1 OZ. TO 60,000 Lbs.

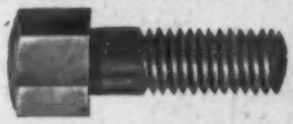
For Rolling Mills, Blast Furnaces, Etc.

GET OUR PRICES.

THE RIPPEL MANUFACTURING CO.

FOUNDRY AND MACHINE WORKS, MT. GILEAD, O.

ILLINOIS SCREW CO.,



40 S. Canal st., Chicago.

POWER TRANSMISSION

W.A. JONES FOUNDRY & MACHINE CO.

53-59 So. JEFFERSON ST. CHICAGO.

WORKS, SHARON. MINES, CLEARFIELD CO., PA

James V. Rose,

. . . PROPRIETOR . . .

SHARON FIRE BRICK WORKS,

Contractor in Fire Brick Construction.
Manufacturer of High Grade Fire Brick.

ANALYSIS:

Brick.		Rock Clay.	
SILICA,	54.50.	SILICA,	47.00.
ALUMINA,	44.20.	ALUMINA,	39.00.
LOSS ON IGN,	.05.	LOSS ON IGN,	13.20
IRON,	.15.	IRON,	.12.

SHARON, . . . PA

SHALL WE SEND YOU ONE?

We want every mechanic and manufacturer to have a copy of our 98 page illustrated catalogue of up-to-date tools and cutters. It is free.

THE L. S. STARRETT CO.,

Athol, Mass., U. S. A.

TURNBUCKLES.

Cleveland City Forge & Iron Co.,

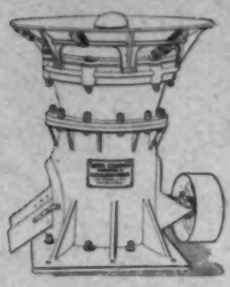
CLEVELAND, O.

THE UPSON NUT CO., Cleveland, O.,

- - - MANUFACTURERS OF - - -

MACHINE AND CARRIAGE BOLTS, HOT FORGED AND COLD PUNCHED NUTS, LAG SCREWS BOLT ENDS, WASHERS, ETC. Catalogue and Prices on Application.

IT PAYS to obtain prices of **WM. B. POLLOCK & CO.** Youngstown, Ohio. Blast Furnaces, Steel Plants, Boilers, Tanks, etc.



CRUSH ORES...

Prepare your ore for market so it will command the highest possible prices. All furnaces want crushed ores.

GATES BREAKER

Is the greatest on earth.

Over 4,000 of them in use.

GATES IRON WORKS, Dept. XX. 650 Elston Ave., CHICAGO.

IT PAYS TO ADVERTISE IN

THE IRON TRADE REVIEW.

STILWELL'S

PATENT LIME-EXTRACTING

HEATER AND FILTER

COMBINED.

Is the only lime-extracting Heater that will prevent Scale in Steam Boilers, removing all impurities from the water before it enters the boiler.

Thoroughly Tested.

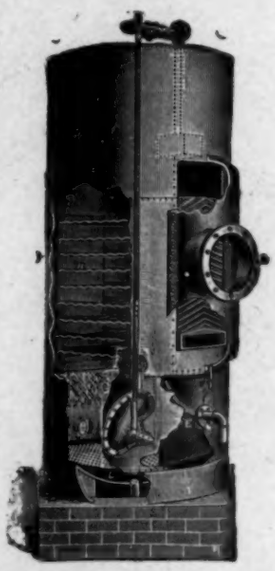
OVER 8,000 OF THEM IN DAILY USE.

ILLUSTRATED CATALOGUE.

Stilwell-Bierce & Smith-Vaile Company,

DAYTON, OHIO.

CHICAGO OFFICE, 63 S. Canal St.



JUNCTION IRON & STEEL CO.

WHEELING, W. VA., and MINGO JUNCTION, O.

MANUFACTURERS OF

Bessemer Pig Iron, Soft Bessemer Steel Blooms and Billets, Soft Steel Bars, scaled and sheared to lengths and weights, for Sheet and Tin Plate Manufacturers, also Soft Bessemer Merchant Bars

SUITABLE FOR

Agricultural Implement Makers, Wagon and Carriage Manufacturers, Car Builders and Locomotive and Railway Repair Shops.

Sales Offices: Room 14, Mason Bldg. Boston, Mass. | 81 Fulton St., New York, N. Y. | 519 Fidelity Bldg., Philadelphia, Pa. | 421 Wood St., Pittsburg, Pa. | 10 Wiggins Blk., Cincinnati, O. | 638 The Rookery, Chicago, Ill. | Security Bldg., St. Louis, Mo.

Rooms 811 and 812 Perry-Payne Bldg., Cleveland, Ohio.

AIR COMPRESSORS

Thoroughly up-to-date and the most simple, durable and economical machines on the market. Built on improved lines.

ROCK DRILLS, AIR LIFT, PUMPS, ETC.

Send for catalogue

RAND DRILL CO.

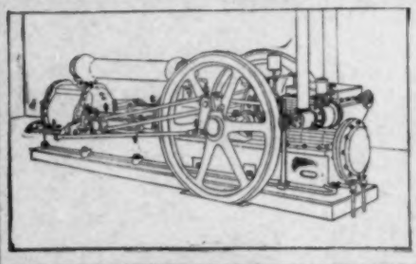
100 Broadway, New York. 1328 Monadnock Block, Chicago.

AIR COMPRESSORS

AND PNEUMATIC APPLIANCES.

CLAYTON AIR COMPRESSOR WORKS

SEND FOR CATALOGUE. 26 Cortlandt St. NEW YORK.



We will send to Engineers and Business men, our circular No. 15, upon Air and Gas Compressors for all purposes and for any desired pressure and volume

THE NORWALK IRON WORKS CO.

301 Water St., SO. NORWALK, CT.

Steel Stamps and Stencils.

FALKHAFTY, J. H. & Co., Rubber Stamps Seals, Stencils, Automatic Check Punches and Numbering Machines. 92 Seneca St.

O. TEXTOR,

Chemist and Metallurgist

Analyses made of Metals, Ores, Fuels and Supplies for Furnaces, Steel Works and Foundries. Ores sampled at mines, furnaces and lake ports. Advice furnished to operators of Blast Furnaces Steel Works and Foundries.

Mining properties reported upon.

For 12 Years Chief Chemist to the Cleveland Rolling Mill Co.

158 Superior St., CLEVELAND, O.

Robert W. Hunt & Co.

1137 The Rookery,

CHICAGO.

Analyses of Iron Ores.
Sampling of ores.
Analyses of all ores, oils, waters, metals, etc.
Inspection and consultation.

F. A. EMMERTON,

Analytical Chemist

AND METALLURGIST.

Ores sampled at lake ports, mines and furnaces. Mines and Metallurgical Processes examined. Analyses made of Ores, Metals, Fuels, Railroad and Foundry Supplies, etc.

9 Bratenahl Building, CLEVELAND, O.

Pickands, Brown & Co.

PIG IRON, IRON ORE

...AND...

FRICK COKE.

929-939 ROOKERY BUILDING, CHICAGO.

Prouty Electro-Gasoline Engine.

Has no equal for Shops, Factories, Dynamos, Hoisting, Pumping, Mills, Boats, Printing Offices, Tractions, Road Wagons.

Built in sizes from 2 to 50 Horse Power.

THE PROUTY CO., 334 Dearborn St., Chicago, Ill.

STURTEVANT ENGINES.

HORIZONTAL AND VERTICAL, SINGLE AND DOUBLE. SIMPLE AND COMPOUND.

SEND FOR CATALOGUE.

B. F. STURTEVANT CO.

BOSTON, NEW YORK, PHILADELPHIA, CHICAGO, LONDON, ENG.

C. K. PITTMAN,

SHIPPER OF

Coal & Coke

Best Grades of Coke a Specialty.

975 Old Colony Building, Chicago.

THE IRON TRADE REVIEW

VOLUME XXX. CLEVELAND, O. FEBRUARY 18, 1897. CHICAGO, ILL. NUMBER 7.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The steel rail war was brief and fierce and the execution was quite all that could be desired. Prices were cut deeply enough to satisfy buyers that there was nothing left for them but to buy all their needs required within the limit of their credit. It is safe to say that nearly $20,000,000 worth of rail business is on the books of the members of the late pool today, nearly all of it taken in five days of last week. If we count 375,000 tons of Pittsburg sales, in addition to 100,000 tons of foreign orders and 100,000 tons of rails optioned to home roads, and to this add 275,000 tons taken by Illinois and about 250,000 tons sold by Eastern mills, we shall have a total of 1,100,000 tons. Of this total an amount more than equivalent to all the rail business of 1896 was taken after the declaration of war on the 9th inst. There is no truce as yet, and no signs that one will be patched up. A lull has come because most of the roads able and needing to buy largely have bought for the year. Later comers find the steel companies far less keen for tonnage and the $17 figure of a week ago, Pittsburg and Chicago, has given way to a $20 quotation, Pittsburg, and $21, Chicago. The Pittsburg mills are practically booked for the year; the Western company for two-thirds to three-fourths of the year, while Eastern mills have all that they can handle for some months. For the most part $20 was maintained on Eastern sales, though some cuts are reported, bringing the price down to $19.50 and in one instance to $19. The effect of the week's events can not be definitely computed; the field has not sufficiently cleared. But the general statement of last week seems entirely borne out. The large attendant business that so great a volume of track work implies is a significant item. A consumption of nearly 2,000,000 tons of Bessemer ores, nearly all from Lake Superior, is involved in the rail business by itself. So great an impetus to activity coming in a single week is taken as a prophecy of widening demand in many lines. One market effect, and a natural one, is the firmer price for billets and for Bessemer pig. With mills busy on rails, billet production will be contracted and prices may be expected to work toward a paying basis. With an outlet made for a large tonnage of Bessemer pig, there is a strengthening in that product, and $10.25, valley, on deliveries into July has been reached. If, in addition to rails, the railroads in their borrowing provide for needed rolling stock, a varied assortment of industries, including car works, locomotive works, wheel foundries, rolling mills and blast furnaces, would be greatly quickened. In a few directions there are faint signs now of a better feeling. Some sellers of foundry iron have had a larger inquiry the past week. Prices of nearly all products, outside of Bessemer pig and billets, are still on the low level of many weeks past. Cheap raw materials in 1897 may prolong the present level or something near it; but more regular operation of mills, when it comes, will at least bring more economical production, if markets are not materially higher. Structural steel has taken no noticeable start. The money requirements of the rail-buying campaign would tend to stiffen rates slightly on the projectors of building enterprises, but there seems no disposition to push matters, even under the present tempting discounts. From the Birmingham district come reports of better sales in the week, one Southern pipe works having placed a fair order, while contracts of from 1,000 to 3,000 tons for foundry grades are noted. Foreign demand keeps up and recent transactions have netted 50 cents a ton more than sales for home consumption. A small sale of No. 1 foundry for shipment to Chile was made at $8.50, furnace.

THE CLEVELAND DISTRICT.

The end of the Iron Ore Association has been announced a number of times in the dispatches of the past week, but its status is exactly what it was before the rail pool was broken. A meeting appointed for Tuesday has been postponed a week and may be further postponed, since there is no reason for attempting to fix prices at present. The possibility of an alliance between the Minnesota Iron Co. and the Illinois Steel Co. which was suggested in December when the Carnegie-Rockefeller deal was announced, has been revived in the past week and put out as a fact. No such arrangement exists, though the official intimation is given in a way that betokens a firm footing, that the Illinois Steel Co. is prepared to meet any price of any competitor. The fact that some stockholders are common to the two companies named suggests an alliance for the benefit of the Chicago district.

Pig Iron A firmer tone in Bessemer pig and some sales at higher prices have come in the week. A round lot has been sold, deliveries extending over six months, beginning with March, at $10.25 valley furnace. Earlier transactions were made at $10.10 and $10.15 in the valley, and sales aggregating 25,000 to one interest at a price reported as "below $10 valley." Furnaces are firmer and some have their figure at $10.50 for farther deliveries. Foundry iron shows somewhat more inquiry and the general belief that a start is to come as the result of the large rail sales has made foundrymen more hopeful. Prices are unchanged and actual orders have not expanded perceptibly. We quote Cleveland delivery:

Bessemer	$10 65@10 90	Valley Scotch No. 1	$10 90
No. 1 Strong Foundry	10 90@11 15	Valley Scotch No. 2	10 75
No. 2 Strong Foundry	10 15@10 40	Gray Forge	9 50@ 9 75
No. 3 Foundry	9 90	Lake Superior Charcoal	13 50

Finished Material. The strengthening of the billet market has given confidence to sellers of finished products. Quotations are $16.50 to $16.75 Cleveland for billets, and the diversion of so many mills from billets to rails is the ground of confidence that higher prices will soon be obtained. Rods are firmer and $22 to $22.50 is a current quotation. Some sales of rails have been made to Northern Ohio roads, the Lake Shore, Toledo & Ohio Central and Wheeling & Lake Erie being among the buyers. There is no intention of rolling rails at the Cleveland Rolling Mill Co.'s mill in 1897, in spite of contrary reports. Structural material is quiet at the moment, owing to a natural skepticism as to pool prices. The steel work on the Hull & Dutton building—1,200 tons—has been taken by the King Bridge Co. and the Bradley building—600 tons—has been let to the Forest City Wire & Iron Co. Bars, iron and steel, are quiet. Plates are quoted 1.25c to 1.30c. Old material is weaker, with old steel rails $10 to $10.50; No. 1 wrought scrap, $10.50; mill scrap, $8; cast borings, $5; wrought turnings, $6.75.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1142 MONADNOCK BLOCK, Feb. 17.

The collapse of the rail pool has been the principal market topic of the past week and it seemed to be the general opinion that the very large sale of rails made by the various steel companies would have the beneficial effect which the market has so long needed. Increased production of rails means in the end increased employment for foundries and machine shops and a larger buying of all materials they use. There is very little doubt that a much increased business in some classes of materials will be done in the near future as a result of the sales of rails. A great many rumors have been current regarding the actual cause of the dissolution of the rail pool but none of them appear to have the stamp of authority. Back of all the local causes, however, is the undoubted fact that the market was exceedingly top heavy, as the price of rails was relatively so much above that of any other material. Various guesses are heard as to the extent of the rail buying in the last two weeks, ranging all the way from 800,000 to 1,250,000 tons; but it is probable that the truth lies between these estimates. Sales have been made in this market alone, almost entirely to Western roads, involving a total of 400,000 tons. The orders were divided up between the local company and the Carnegie Steel Co., but by far the larger portion will be rolled in Chicago. As to prices, authorities differ. One claims that all of the sales were made at $17, Chicago, or less, while another claims that a large portion of the business went at $18. The fact remains that the Eastern competitor for the business sold at $17; and it is reported with considerable show of truth that the Carnegie company sent a message Tuesday night of last week to the buyers of all the railroads of the country offering rails at $17, mill, and to purchasers naturally tributary to the Western mill, offering them at a basis of $17, Chicago. At present the market is nominally $21, Chicago. Each inquiry, however, is taken up by itself, and a special price made, regulated by the size and delivery of the tonnage called for and the standing of the inquirer. Outside of steel rails the market last week was quiet and no large contracts for any class of material were placed. Two or three projects involving the erection of large warehouses are being considered, and it is likely that they will be put through at an early date. The Great Northern Railroad has also asked for an estimate on the steel required for a 2,000,000 bushel elevator which it will build at Buffalo within a short time. The plans call for a building constructed entirely of steel with steel plate bins. This will necessitate the purchase of about 5,000 tons of material of all kinds and shapes.

PIG IRON.—The market has not been affected by the events in the steel rail market and while these will undoubtedly have some influence in the future it is not likely the demand will be increased immediately. There is, however, a better tone to the market, exemplified by a greater willingness on the part of buyers to consider making purchases. Orders for small lots are rather more frequent than they have been of late but no large contracts have been closed. The total tonnage is probably not larger than that of the few previous weeks. Prices are unchanged and are being maintained on the small business that is going, by both Northern and Southern furnaces:

Lake Sup. Charcoal	$13 50@14 00	Southern No. 1 Soft	$10 90@11 40
Local Coke Fdy. No. 1	11 50@12 00	Southern No. 2 Soft	10 65@10 90
Local Coke Fdy. No. 2	11 00@11 50	South'n Silveries	11 40@11 65
Local Coke Fdy. No. 3	10 75@11 00	Jackson Co. Silveries	14 00@16 00
Local Scotch Fdy. No. 1	11 50@12 00	Ohio Silveries No. 1	15 00@15 50
Local Scotch Fdy. No. 2	11 00@11 50	Ohio Silveries No 2	14 50@15 00
Local Scotch Fdy. No. 3	10 75@11 00	Ohio Strong Softeners	14 00@14 25
South'n Coke No. 1	11 15@11 40	Alabama Car Wheel	16 00@16 50
South'n Coke No. 2	10 65@11 15	Malleable Bessemer	12 00@12 25
South'n Coke No. 3	10 40@10 65	Coke Bessemer	13 00@13 50

BAR IRON.—Considerable business is being done in small lots but no orders of particular note have been taken in the last week. Makers of steel bars are disinclined to take further orders at the present price but as yet have not advanced quotations. Prices are made as follows: Common iron, 1.25c to 1.30c; soft steel bars from strictly billet stock, 1.15c to 1.25c.

RAILS AND TRACK SUPPLIES.—The local steel company reports that the rail market is quiet after an active week. It also says that it has sold considerable tonnage of rails at the minimum of $18, Chicago, and that the firm price to-day if deliveries are satisfactory is $21, Chicago. Sales have been made in the last week to nearly all of the prominent Western roads and an aggregate of at least 400,000 tons has probably been closed in this city. The roads have bought in lots of from 45,000 tons down and have verified the remark made in this column two weeks ago that they were only waiting for what they consider a fair price to be made before placing orders for large lots. The demand for track supplies has not as yet come up to the sales of rails but is naturally very much better than it was before and will undoubtedly be increased in the near future. Prices are made: Rails, $21; splice bars, 1.40c to 1.45c; track bolts with square nuts, 1.95c to 2c; hexagon nuts, 2.05c to 2.10c; spikes, 1.65c to 1.75c.

BILLETS AND RODS.—This market has been quiet and sales have been limited to small lots. Prices have been advanced and are now made at $18 for billets and $24 for rods.

STRUCTURAL MATERIAL.—Several warehouses which will involve the purchase of a considerable tonnage of material are projected and will undoubtedly be contracted for within a short time. The Great Northern road has asked prices on 5,000 tons of material for an all-steel grain elevator of very large capacity which it will build in Buffalo. General business has been quiet and orders have been limited to small lots. Quotations are as follows: Beams and channels, 1.73c to 1.80c; angles, 1.25c to 1.30c; plates, 1.25c to 1.30c; tees, 1.50c to 1.55c. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—The inquiry is a trifle better than it was a week ago but is still limited to small lots. Prices are made as follows: Tank steel, 1.25c to 1.30c; flange steel, 1.45c to 1.55c; fire-box, 2c to 5c.

SHEETS.—Both black and galvanized sheets have been in rather light request in the last week and sales are only small. A better market is looked for within the next two or three weeks. Quotations are made at 2.15c to 2.20c for No. 27 black and 80 to 80 and 5 per cent discount for galvanized.

MERCHANT STEEL.—Sales have been quite satisfactory to the dealers although they do not include any of very large size. Prices are as follows: Open-hearth spring, tire and machinery steel, 1.85c to 1.95c; smooth finished machinery steel, 1.60c to 1.65c; smooth finished tire, 1.55c to 1.65c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

OLD MATERIAL.—Two lots of old material were sold in this market last week by railroads, both of them involving considerable tonnage and one including 1,000 tons of rails. Aside from these business was limited and the demand does not indicate an increase in the immediate future. Prices are made at $12.50 and $13 for old iron rails; $9 to $9.50 for old steel rails, and $11 for old wheels. Miscellaneous scrap is quoted about as follows: Railroad forge, $11.50 to $12; dealer's forge, $10 to $10.50; No. 1 mill, $7 to $7.50; heavy cast, net ton, $7.50 to $7.75; malleable cast, net ton, $8.50; axles, $13; cast borings, $3; wrought turnings, $4; axle turnings, $5.50 to $6; mixed steel, heavy, $7.50; stove plates, $5.50; heavy melting steel, $9.00 to $9.25.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
807 TRADESMEN'S BUILDING, Feb. 17.

Results of the flurry in rails are already apparent in a stiffening of quotations on billets and an enlarged inquiry. Bessemer is likewise in better condition, and with the present week have come firmer quotations and withdrawals of previous options. Later developments in rails given elsewhere have only intensified the feeling of expectancy which resulted from the collapse of the pool last week. With the year's output of the local works taken, the situation has quieted materially, but other finished lines already feel the impetus and a distinctly better tone prevails.

PIG IRON.—The transactions of the week in iron have been numerous and show considerable variation in price. Lots of 10,000, 5,000, 3,000, 1,500 and several of 1,000 tons are reported, aggregating not far from 25,000 tons. While it is claimed that speculation has been the moving factor, more favorable indications are not lacking and the week closes with a better outlook. Prices on last week's transactions range from $9.75 to $10.75 for valley iron for shipments through April, and in one case till May. In one instance $10.25, valley, was obtained, shipments to July 1. The authentic sales announced include 5,000 tons at $9.85, valley; 1,500 tons at $10.65, Pitts-

burg, and 10,000 tons at $9.75, valley. Subsequent sales are firmer and offers of $10, valley, have been refused in the present week. No offer less than $10.80, Pittsburg, is made by furnaces and more is asked. Notwithstanding the better situation, no radical change can be attributed to steel rail happenings. Foundry grades are active only in small lots but show a heavier inquiry. Gray forge at $9.50 to $9.75 is stationary. We quote, f.o.b., Pittsburg:

Bessemer	$10.65 to $10.90
No. 1 Foundry	11.25 to 11.50
No. 2 Foundry	10.50 to 11.00
No. 3 Foundry	10 00 to 10.25
Gray Forge	9 50 to 9.75

Later.—A leading non-consuming interest is reported to have bought 25,000 tons of Bessemer pig this week at a shade below $10 valley furnace. The total sales of the week are close to 75,000 tons.

BILLETS AND RODS.—The effect of the rail situation is already evident in the increased interest in billets. Several large inquiries are out at present and are encountering advanced prices. Offers of $15 on large tonnage are refused by mills, their quotation being $16, which is not shaded materially, Middlemen's offerings at $15.50 to $15.75 are not extensive. The week has seen few orders closed either in billets or rods. The latter at $21 are fairly active.

RAILS AND TRACK SUPPLIES.—Conservative estimates of the rail tonnage sold during the week, or held under option at present by Pittsburg, range from 450,000 to 475,000 tons, with some 100,000 tons additional said to be sold for export. With Edgar Thompson thus booked for 12 months the local interest held $18 as minimum in the latter part of last week and is now quoting $20 The collapse of the pool and the price-war that followed were told last week and are now history. The effect, however, is felt in every branch of the trade. Naturally the most active lines just now are in splice bars, fish plates, track bolts and spikes. We quote Pittsburg prices as follows: Rails, $20; splice bars, 1.40c to 1.45c; steel spikes, 1.65c to 1.75c; track bolts, iron, 1.95c to 2c.

STRUCTURAL MATERIAL.—Spring business is beginning to appear and estimates are being asked on considerable work. Present business is contracted. Angles and universal plates are slightly firmer. We quote: Beams and channels, 15-inch and under, 1.55c; 20-inch, 1.70c; 24-inch, 1.75c; angles, 1.10c to 1.15c; zees, 1.30c to 1.35c; tees, 1.35c to 1.40c; universal plates, 1.10c to 1.15c.

BARS.—The week's business in steel bars showed improvement over recent weeks. Upwards of 4,000 tons are reported sold, including three lots of 1,000 tons each. Prices are little better, but talk of sales at .90c and .95c has in a measure subsided, and 1.05c and 1c respectively are held by the two leading interests; 1c by mills less fortunately booked. Bar iron at 1.15c, nominal, Youngstown, finds limited sale against steel. Muck bar is quoted at $19 to $19.50.

PLATES.—Advanced prices of sheared plates are well maintained here and outside mills are likewise asking more for business not covered by season contracts. Railroad requirements for the week, in fire-box and boiler steel, show increased tonnage. Local mills are now asking on tank, 1.15c to 1.20c; shell, 1.25c to 1.30c; flange, 1.35c to 1.40c.

WROUGHT PIPE.—The week's business in wrought pipe has been in the main satisfactory and an improvement over the volume had of late. Complaints are heard that only actual necessities are being covered and stocks allowed to become entirely exhausted. Prices are quoted as follows: Merchant pipe, 57 to 67 per cent, and for galvanized, 50 to 55 per cent; six tens on car load lots and five tens and 5 per cent on smaller lots. On merchant boiler tubes we quote: Two and a quarter inches and smaller, 70 and 10 per cent discount; two and a half inches and over, 75 and 5 per cent discount; casing, inserted joints, 57½ per cent discount; screw and socket joint, 62½ per cent discount.

SHEETS.—The regular meeting of the sheet manufacturers is in session at this writing, but the business to be transacted is routine. Business in both black and galvanized sheets shows a slight change for the better. Black sheets are quoted as follows: No. 26, 1.90c to 1.95c; No. 27, 2c to 2.05; No. 28, 2.10c to 2.15c. Galvanized are quoted at 80 to 80 and five per cent off list.

MERCHANT STEEL.—Soft steel bars are in much better demand and there is likewise a better condition in all grades of tool steel. Foreign orders are more numerous. We quote: Machinery steel, 1.30c to 1.35c, base; sleigh shoe, 1.30c to 1.35c; soft steel bars, 1.20c; machine straightened, tire, 1.30c to 1.40c; spring, 1.30c to 1.35c; open-hearth spring, 1.55c to 1.60c; toe calk, 1.45c to 1.55c; tool steel, common, 5c to 7c. Special brands, 10c and upwards.

IRON AND STEEL SKELP.—We continue to quote: Grooved steel skelp, 1c to 1½c; sheared, 1.07½c to 1.10c; grooved iron skelp, 1.15c to 1.17½c; sheared, 1.30c to 1.35c.

OLD MATERIAL.—A desire to dispose of old steel rails is noticed as a result of the purchases of rails and the prospective stocking of the market with old material. Buyers are not found and prices continue as follows: Wrought scrap, $11; cast scrap, $10 to $10.25; car wheels, $11.50, gross; old steel rails, $13 to $13.25; coil spring, $10.75 to $11, gross; hammered iron axles, $16 to $16.50, net; rolled iron axles, $14 to $14.50; heavy melting stock, $12.50 to $13; machinery cast, $9.75 to $10.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Cincinnati. The dissolution of the rail pool, with the large tonnage of rails placed in consequence, and the attendant tonnage of fish-plates, bolts, splice bars, etc., is indicative of a break-up of market stagnation. There is some encouragement, too, in the continued demand abroad for American pig iron, limited for the time being by inadequate shipping facilities. There is a slight improvement in consumption, but non-Bessemer stocks as yet feel no quickening from the stimulations referred to. The accumulations of stocks at the furnaces of the South not participating in export business, including storage warrant iron, aggregate approximately 900,000 tons. There is an improved demand for pig iron and sales though in the main confined to small and 100 and 200 ton lots are more numerous. We quote for cash, f.o.b. Cincinnati: Southern coke, No. 1 foundry, $10.50 to $10.75; No. 2, $10 to $10.25; No. 3, $9.50 to $9.75; Gray Forge, $9.25 to $9.50; mottled, $9.25 to $9.50; No. 1 soft, $10.25 to $10.50; No. 2, $9.75 to $10; Hanging Rock charcoal, No. 1, $15 to $16; Tennessee charcoal, No. 1, $13 to $14; Jackson Co. silvery, No. 1, $13.50 to $14; standard Alabama car wheel, $14.75 to $15.50; Tennessee, car wheel, $13.50 to $4.50; Lake Superior car wheel and malleable, $14.75 to $15.25.

Phiadelphia Speculation as to the tonnage of rail orders closed with Eastern mills in the past week is interesting. The estimates run from 175,000 to 250,000 tons, and it is believed the latter figure is not far off. There appeared to be a quasi understanding among Eastern mills to maintain $20, but there has been more or less underselling; in one instance, it is stated, $19 having been touched, and on another order $19.50. Pig iron has had some activity and the sales of basic iron, some of which were completed before last week's report, amount to 30,000 to 40,000 tons, at $10.50 to $10.75, delivered at Eastern Pennsylvania mill. A fair business has been done in mill and foundry grades, prices on the latter being at figures of the past few weeks. We quote: No. 1 X foundry, $12.75 to $13.25; No. 2 X foundry, $11.75 to $12.25; No. 2 plain, $11.25 to $11.50; standard mill iron, $11 to $11.25; ordinary mill iron, $10.75. The billet market is firmer and prices recently available are not talked about now. For deliveries in the next two months $17.50 is a possibility, and for farther future delivery $18 is quoted. In building material there has been no change in the week and there may be a season of waiting. Plates are a little improved in demand and sales of bars are somewhat larger, but with no improvement in prices. Mills are occupied only in part and for the present it would seem that quite low prices will prevail. On beams and channels, 1.70c is still minimum; plates are quoted 1.25c to 1.30c, bars 1,15c to 1.20c and angles 1.25c to 1.30c.

Buffalo. The past week has shown a little improvement in the volume of pig iron sales, but business still drags and prices are only firm because there is no room for further reductions. Outside of two transactions, which were each for over 1,000 tons, we hear of no business in the week larger than 100 and 200 ton lots in this district. We quote, on a cash basis, f.o.b. cars at Buffalo: No. 1 foundry, Lake superior ore, $12; No. 2, $11.50; Ohio strong softener, No. 1, $12.25; No. 2, $11.75; Jackson County silvery, No. 1, $14.25; Southern soft, No. 1, $12; No. 2, $11.50; Lake Superior charcoal, $14.

THE IRON TRADE REVIEW

DEVOTED TO IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES.

PUBLISHED EVERY THURSDAY BY
THE IRON TRADE REVIEW CO.,
CLEVELAND, OHIO.

CLEVELAND, 27 VINCENT STREET:
G. H GARDNER President. A. I. FINDLEY, Editor.

CHICAGO:
1142 MONADNOCK BLOCK.
B. M. GARDNER, Associate Editor and Western Manager.

PITTSBURG:
807 TRADESMEN'S BUILDING.
JAMES R. MILLS, JR., Manager.

Subscription (strictly in advance), $3 per annum. Advertising Rates Furnished on Application.

The Cleveland News Co. will supply the trade with THE IRON TRADE REVIEW, through the regular channels of the American News Co.

ENTERED AT THE POST OFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER.

FEBRUARY 18, 1897.

EFFECT OF COMPETITIVE PRICES ON RAILS.

How the break in the steel rail pool came about and which member was first to depart from the agreement are matters that have little attention now, the uppermost question with the iron trade being the results that are to flow from the events of the week. There is little dissent from the view that while the loss of profit is a matter of much moment to the producers of rails there will be gains in many ways, not only to the iron industry at large but to the business of the entire country. Twenty million dollars worth of business done in a single week, is prodigiously significant when compared with the almost complete absence of purchases by the railroads for many months past. The stimulus given to trade through the employment of thousands of men in rail mills that have started on full schedules, and the employment of tens of thousands in the track-laying programme that is just ahead, is alone a consideration of vast significance in this time of slack employment and wide-spread poverty.

The wage phase of the war in rail prices has had considerable attention in the week. The Cambria Iron Co. and the Pennsylvania Steel Co. have posted notices of 10 per cent reductions, due in both instances to the low prices on rails under a competitive market. At the Carnegie Steel Co.'s mills the wages of tonnage men vary with the price on rails, the market minimum of the sliding scale being $17. The men will therefore receive the minimum price per ton on most of the work turned out in 1897. It having been the practice to run the Edgar Thomson mills to full capacity whenever rails are rolled, it follows that less money per ton now will also mean less money per day. Yet in the year's operations the men will do far better than in any recent year, as it has been a long time since such a year's tonnage has been put out as will come from these mills in 1897. At all rail mills the effect will be the same—a smaller wage for a day's run, but a total wage for the year that will be considerably more than the men have had in any of the late years of intermittent operation.

In other departments of the iron industry the effect will not be greatly different. The absence of accustomed rail profits will check the slaughtering of prices on other products, it is true, but until demand grows to distinctly larger proportions the absence of profit on every class of material, beginning with ore; will tend to depress wages. That is the inevitable tendency of the competitive regime; and it remains to be seen whether the hue that has gone up ceaselessly in the past few years against combinations for the purpose of holding up prices will not be modified by the experiences that are likely to come to labor in the struggle for tonnage that is ahead of the iron trade. In iron ore the certainty that prices will be lower and that a portion, at least, of the Bessemer output for 1897 will be outside of any price agreement, has already resulted in wage reductions at a number of mines. It will yet be seen which is preferable, from the standpoint of the wage-earner, concentration of ore business in fewer hands, with lowering prices to consumers, or the maintenance of a remunerative price that permits a larger number of producers to get a profit and to pay good wages to their employes.

The armor plate proposition brought to the attention of Congress a few days ago may properly be treated as a phase of steel rail hostilities. The bill of Representative Lorimer, authorizing the Secretary of the Navy to contract with any responsible American manufacturer for armor plate at a maximum of $240 a ton was accompanied by the statement that the Illinois Steel Co. will engage to erect an armor plate provided the Government will give it a contract for its armor plate for 20 years at $240 a ton. So far the House Committee on Naval Affairs seems not disposed to entertain seriously the proposition from Chicago. Two well equipped armor plate plants have already been offered to the Government at a price to be fixed by appraisal, and the facts brought to the attention of the Senate committee recently have convinced members who were disposed to insist on a radical reduction in the price, that the business of armor plate manufacture must be judged by rules applicable to it alone. For example, a 10 per cent depreciation charge must be the basis of safe figuring, as against 6 to 8 per cent for other forms of plant.

What the outcome will be, if the spirit of retaliation evident in the armor plate proposition, as well as in some details of the $17 rail campaign, is allowed full sweep, is not pleasant to contemplate. Now that the mills are filled up for months, there will be a chance for blood to cool, and the desirability of making profits may grow into a factor of more consequence. It will be exceedingly difficult to get railroads to consider rails at anything beyond a $20 basis; and, for that matter, the day of attractive profits in any line of steel manufacture are behind us.

THE December statistics of iron and steel imports to the United States show more plainly than any preceding, the falling off in the amount of foreign products marketed in this country. The pig iron, tin plate, bar and ingot items are conspicuous in

the decline. Below are the figures, as tabulated by the Treasury Department for December, 1895 and 1896, and the two calendar years:

IRON AND STEEL IMPORTS TO THE UNITED STATES.—GROSS TONS.

	December.		Jan.-Dec.	
	1895.	1896.	189 .	1896.
Pig iron	11,770	970	53,232	56,272
Scrap iron and steel	1,071	316	6,066	8,250
Bar iron	2 948	1,012	20,049	16,276
Iron and Steel Rails	24	.....	1,447	7,793
Hoops and band iron	.....	.....	15	26
Ingots, blooms, etc	5,499	947	26,255	20,356
Sheets and plates	899	252	14,524	6,497
Cotton ties	.....	10	3,485	7,156
Tin plates	13,649	5,510	219 588	119,006
Wire rods	2,479	1,643	26,931	18,987
Wire	364	220	5,777	3,674
	33,703	10,880	377 372	264,296

TRADE BALANCE IN IRON AND STEEL.

The December statistics of iron and steel exports from the United States are now available, making possible the summation of a year of important developments in this trade. So much has been said about the shipments of machinery in the past year, that the statistics have been quite discounted in the publication of the monthly statements. Pig iron exports, also, have had quite their share of attention. But the December statistics show as did those of no other month the gathering volume of the shipments from the Birmingham district. While 1,887 tons of pig iron was exported in December, 1895, the total for last December was 17,335 tons. The classification "ingots, bars and rods of steel" shows a strong increase; steel rails, also, and wire and nails. In the case of "ingots, bars and rods of steel" the increase is largely due to shipments of billets, sheet and tin plate bars and wire rods from the Pittsburg district. On some of this material, a combination rail and water rate of $3 was secured from Pittsburg to Liverpool or Continental ports. This rate is amazingly low and the $5 rate lately prevailing is nearer what may be expected under ordinary conditions. Further considerable shipments of steel are understood to have been made from Pittsburg, with foreign destination, since the opening of the year.

The items which show a particularly large increase in exports in December and for the year 1896 over 1895 are the following, gross tons being given:

EXPORTS FROM THE UNITED STATES OF CERTAIN IRON AND STEEL PRODUCTS.

	Dec., 1895.	Dec., 1896.	Year 1895.	Year 1896.
Pig iron	1,887	17,335	26,164	61,071
Steel ingots, bars and rods	42	1,404	3,147	8,855
Cut nails	842	864	7,875	10,584
Wire nails, tacks, etc	143	7,114	2,365	4,270
Steel rails	233	10,925	8,807	72,503
Wire	3,017	5,159	29,475	38,043

It is interesting to note how the balance of trade in iron and steel and their manufactures has been steadily working in our favor in recent years. The turning point came in 1893, when our iron and steel exports slightly exceeded the imports. The following statement shows the relation between the two quantities for the past seven years:

IRON AND STEEL IMPORTS AND EXPORTS OF THE UNITED STATES.

Calendar Year.	Imports.	Exports.		Excess.
1890	$44,540,413	$27,000,134	Imp.	$17,540,279
1891	41,983,626	30,736,507	"	11,247,119
1892	33,882,447	27,900,862	"	5,981,585
1893	29 656,539	30,159,363	Exp.	502,824
1894	20,843,576	29,943,729	"	9,100,153
1895	25,772,136	35,062,838	"	9,290,702
1896	19 506,576	48,670,218	"	29,163,642

Thus in seven years a change of nearly $50,000,000 has been made in the balance of our iron and steel trade alone. The jump from $9,000,000 in our favor in 1895 to $29,000,000 in 1896 is phenomenal; yet it may be taken as but a prophecy of larger things in 1897. Of the falling off of imports in 1896 as compared with 1895, tin plates contributed $5,300,000. Of the increase in exports machinery contributed $7,700,000, steel rails $1,500,000, pig iron $600,000 and wire $400,000.

UNJUST INSOLVENCY LAWS.

The *Railroad Gazette* makes some comments upon the developments in connection with one case of insolvency that, unfortunately, is not isolated. Referring to the outcome of the effort to reorganize the Memphis (Tenn.) Car & Foundry Co. our contemporary says:

This company has been for some time in the hands of a receiver, and the claims of general creditors were filed under the orders of the chancery court. Last September a plan of reorganization was issued which was so satisfactory that it was accepted by 98½ per cent of the total indebtedness. Now, however, the chairman of the reorganization committee informs the creditors that the plan of reorganization is for the present abandoned. Just before the chancery court entertained the final motion in the matter a number of Tennessee creditors withdrew, claiming that their accounts should be paid first in full. Their position is that under the laws of Tennessee, creditors, citizens of that State, are entitled to full priority over creditors living in other States. Their action prevents any distribution of cash on hand until this claim is disposed of. If the courts allow such priority it will take all the money in the hands of the court or the receiver to settle the Tennessee claim. If the courts uphold the Tennessee creditors only a portion of the proceeds of the sale of the plant would be left for the non-resident creditors. The committee is therefore powerless to move further in the matter of the reorganization until this claim of the Tennessee creditors is settled one way or the other. We regret to have to publish this, but it seems to be a duty to bring such a fact to the attention of dealers in railroad supplies that they may observe due caution in giving credits in Tennessee.

The above is in line with this comment made by *The Iron Trade Review* about a year ago, in view of some unsavory features of certain failures which were then disturbing iron and steel houses in the Central West. Then, as in the case cited by the *Railroad Gazette*, Tennessee laws were a source of complaint:

Several recent assignments, notably in Michigan and Tennessee, in which iron and steel manufacturers and jobbers have an unpleasant interest, have emphasized the crying need of a uniform bankruptcy enactment. The loopholes of legislation on this subject in certain States are enough to discourage any effort by outside companies to do business in them. Recent events have shown that some of these statutes are only a cover for fraudulent preferences and convenient schemes to wipe out the old score and hand over the plant to those who contracted the unpaid liabilities.

National bankruptcy legislation that shall give sellers some assurance that they will have even treatment in handling the assets of insolvent debtors has been long enough agitated, but the day of injustice and fraud is still prolonged. Yet the States whose laws make it easy for debtors to fail profitably, or for local creditors to monopolize assets, are seriously hurting themselves, while they thus embarrass the outside business world in its efforts to do business with them. Every dollar unjustly secured to State creditors means many dollars in trade permanently driven away by the self-imposed ban.

GEAR-CUTTING MACHINE.

A machine for cutting internal gear-teeth has been designed by Thomas J. Lindsay, of Lafayette, Ind. Several teeth can be cut at a single operation by using this machine and in addition to the rapid execution of the work, the stress of the work is equal in all directions outwardly from a common center, securing uniformity of product, and heavy clamping devices are dispensed with. The illustrations give, in Fig. 1, a vertical sectional view; in Fig. 2 a horizontal sectional view, and in Fig. 3 a side elevation. In the cuts, A represents the framework of the machine, B a rotable table

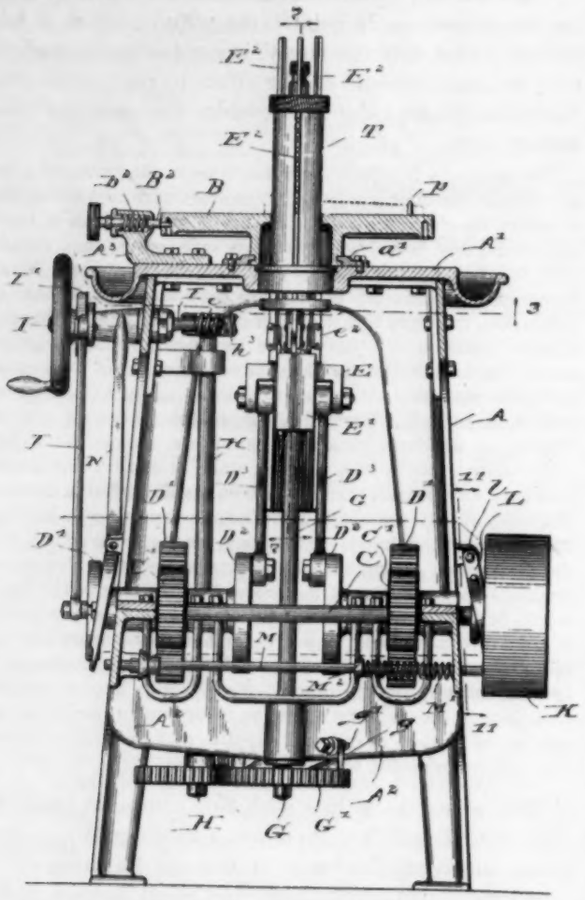


FIG. 1.—VERTICAL SECTION.

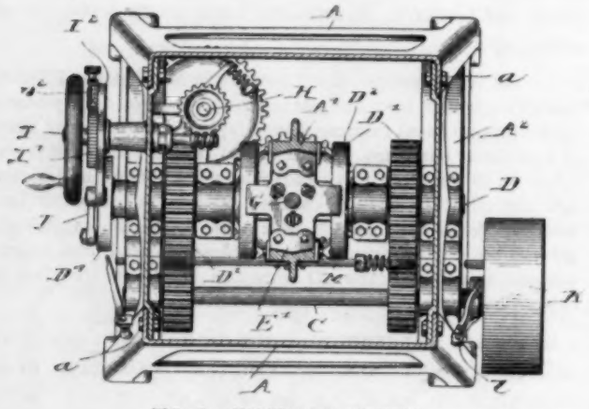


FIG. 2.—HORIZONTAL SECTION.

mounted upon it, C a driving-shaft, D crank-shafts, E a cutter-head, F a cam-feeder for the cutters, G a shaft or rod by which the feeder is operated, H a shaft by means of which the feeder-operating shaft is intermittently driven, I a shaft by which, through a worm-gear the shaft H is driven, K a driving-pulley, L a clutch yoke and M a rod for operating it, N a lever for throwing the rod and clutch into operating condition and O a detent for holding the rod when so operated. In Figs. 1 and 3, a piece of work is shown on the work-table B, as indicated by dotted lines, in Fig. 1. A bicycle crank arm is selected, though the machine is adapted to cutting internal gears upon any mechanism. The means for holding the work in position consist in pins b and clamp-jaws B′, the latter being held to the table by bolts b' and operated by cams b^2. The table B, as shown in Fig. 3 has a row of perforations in its periphery. These perforations are equal in number to the number of cuts which it may be desired to make with the machine. A bracket A^3 on the table-top A′ carries a locking-pin B^2, which is adapted to engage with either of said perforations. In Fig. 1 this pin is shown as surrounded by an operating-spring b^3, by which it will be normally held into engagement. The operation is, after a series of cuts have been made and it is desired to shift the machine for a fresh series, that this locking-pin is retracted by hand, and thus disengaged from the perforation with which it registers, the table B revolved to the position required for the next series of cuts, and the locking-pin inserted in the perforation with which it newly registers. These perforations being carefully spaced and the locking-pin accurately fitted, a very high degree of accuracy of operation is secured, particularly in view of the fact that the point of engagement of the table with the locking-pin is at a much greater distance from the axis than the cutters, and so the proportion of variation, if any at all exists, is very much reduced at the point of cutting.

The method of regulating the speed of feed is indicated in

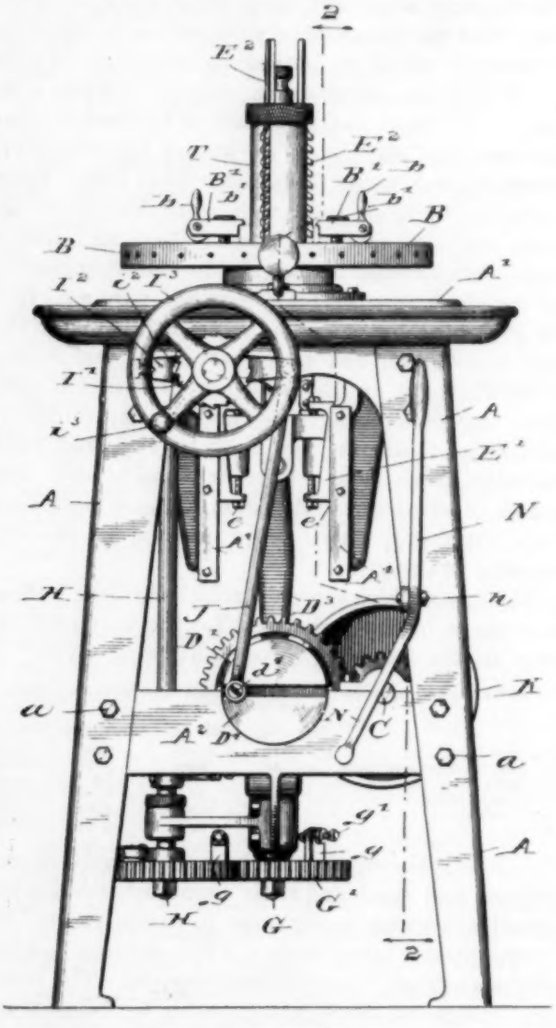


FIG. 3.—SIDE ELEVATION.

Fig. 3. The rocker-arm I^2 has at one end a pawl, i^2. The other end of the rocker-arm is connected by the pitman J to a crank-wheel D^4 on the outer end of one of the crank-shafts D. As shown in Fig 3, the wrist-pin d^4 of the crank-wheel is adjustably connected thereto, being mounted in a transverse slot in its face, and the stroke of the pitman may thus be varied as desired. As the crank-shaft revolves, the rocker-arm is reciprocated, and from it the cam-feeder, through the shafts I, H and G and their gears, is rotated, and thus the cutters are fed out as the cutting progresses. Preferably there is placed upon the extreme outer end of the shaft I a

hand-wheel I^3, having a handle i^3, by which, when a cut has been finished, the feeding mechanism can be rapidly turned in the reverse direction until the cam-feeder has been revolved to a position which permits the cutters to be retracted to their initial position, this being easily permitted without withdrawing the pawl i^2 from engagement with the ratchet wheel I'.

The gear-wheels H' and G' and shaft G are permitted to remain stationary during a portion of the travel of the shaft H by means of the spring engagement between the wheel H' and the shaft H. The purpose of this is to stop the feeding of the cutters forward for a brief period before their reciprocating motion is stopped, thus enabling them to entirely clear themselves in the work and make smooth teeth. The parts are so adjusted that these few final strokes take place while the detent O is being moved by means of the arm H^3, the spring s being compressed by the arm H^2 at the same time. When the feeding mechanism is turned backwardly and the contact between the arms H^3 and O^2 is thus separated, the spring O' returns the detent O to its normal position, its movement in this directing being stopped by the collar o. The tapered rear side of the catch-collar M^2 enables said catch collar to slide under and temporarily push aside the detent O, as the shaft M is being forced back by the lever N, and when forced into place said detent swings behind said catch-collar and holds it, as before. The machine then proceeds with its work, and so on until the set of teeth provided for are completely finished.

The machine having several cutters equally disposed about the center, and being fed outward uniformly by a feed device against which they all equally bear, there is no sidewise strain upon the mechanism, and thus all danger of unequal cutting is obviated. There being several cutters which all work at once, the speed of the machine is also multiplied over a machine where single cutters are used, and bythe automatically-operating feeding mechanism, absolute uniformity is secured in the travel of the cutters, the machine being automatically thrown out of operation when the predetermined point is reached.

THE HUNT STEEL RAIL SPECIFICATIONS.

The following brief paper by Robert W. Hunt, presented at the meeting of the American Institute of Mining Engineers at Chicago this week, is interesting on two accounts at least. It gives the practical outcome, thus far, of Mr. Hunt's more rigid specifications for steel rails, presented at the Atlanta meeting of the Institute in 1894. It also makes some pertinent observations, from an engineering and metallurgical standpoint, on the paramount importance of other considerations than cheapness in connection with rail purchases. We reproduce the paper entire:

"At the Atlanta meeting of the Institute, October, 1895, I had the honor of presenting a paper on 'Specifications for Steel Rails of Heavy Sections Manufactured West of the Alleghenies.' In it, reasoning from the experience of Western railroads with heavier sectioned steel rails, I called attention to the importance of the chemical composition of the steel, and urged the increase of the carbon percentage, and the limiting of phosphorus to the lowest point reconcilable with commercial considerations; and also insisted on the value of added silicon.

"My paper has been honored by the favorable consideration of a number of the engineers and other controlling officers of Western roads, and it resulted in over 186,000 gross tons of rails of sections heavier than 65 lbs. per yard being manufactured since that time in accordance with my views. These rails are in the tracks of several large railway systems. In giving the above tonnage I refer only to the rails which came under my immediate supervision; that is, under the inspection of my firm. Over 69,000 tons were 80 lbs. to the yard.

"In some cases it was not commercially possible to obtain quite as low a percentage of phosphorus as desired, and hence the carbon was reduced proportionally, but, as a whole, the rails could be classed as high carbon ones. Of course, it is too soon to form a positive opinion in relation to the wear of the rails; but practically all of them have been in service long enough to demonstrate their safety. And I believe in all cases the users of the rails unite in the opinion that so far they promise much better wearing results than previously obtained. I know in several instances, based on such showing, still harder steel will be insisted upon in this year's deliveries.

"I present this short article somewhat in the nature of a 'report of progress.' Moreover, in view of the recent somewhat surprising developments in the American rail trade, it is well not to lose sight of the necessity of not permitting low prices to be the only consideration. The first cost of rails is not all the story. This does not require discussion. If it is necessary to pay a little more for a good rail, true economy speaks in no uncertain voice in favor of so doing. Low prices are very attractive, but subsequent economies in track maintenance, repairs to rolling stock, possibilities of high speed, and comfort of passengers must not be ignored.

"The peculiarities of human nature must be remembered. They do not change very much. When articles are sold at a low price those in direct charge of the manufacture of them will, most likely, be expected to keep cost of production down to a corresponding degree. This may lead to temptation to cut some corners, which had better have remained in full projection. At all events it does not seem wise to ignore past experience in steel rail metallurgy."

In a recent address before the House Committee on Rivers and Harbors, Mr. James Bowron, of the Tennessee Coal, Iron & Railroad Co., said that by the construction of a canal to the Warrior River, cheap transportation to the Gulf would be assured which would enable the Birmingham district to dictate prices for coal and iron to the whole world. The great wealth of the district lay in the fact that iron, coal and limestone all lay practically together, insuring minimum cost of delivery to furnace. Nothing but slack water navigation to the Gulf was needed. Of the iron export trade, he stated that the sales since July last would aggregate 100,000 tons, and iron was being landed at Bremen more cheaply than it could be loaded into boats at Middlesboro in England, which has always ranked as the cheapest iron market in the world. The water way once opened would give a rate of 40 cents per ton, against the present rail rate of $1 per ton, and would open to Alabama the iron trade of Continental Europe.

The following notice was posted by the Cambria Iron Co. at its Johnstown, Pa., plant on Feb. 12: "Owing to the generally depressed prices ruling in the steel trade, and especially the severe drop in the price of rails which the Cambria Iron Co. neither caused nor followed until compelled to do so, in order to secure sufficient tonnage to keep the mills in operation, and in order to enable the company to partially meet the losses involved, a reduction in all salaries and wages in each office and department connected with the company, averaging 10 per cent, will go into effect March 1, 1897. By order of the board of directors; G. C. Price, General Manager."

The latest project for steel-making in the South, as already mentioned in these columns, is in connection with the Birmingham Rolling Mill Co. President Caldwell is quoted as proposing on behalf of his company to furnish $35,000 of the amount necessary to put up a small plant, provided Birmingham will raise $40,000. This latter amount is now assured, and a meeting of the rolling mill company's stockholders is to be held to perfect plans. Basic open-hearth is undoubtedly the intention, though some of the articles on the subject refer to the purchase of "converters."

The American Pig Iron Storage Warrant Co. had in yard Jan. 31, 212,000 tons. In the ten days ending Feb. 10 there was added 700 tons, and withdrawn 1,300 tons, making net stock in yard Feb. 10, 1897, 211,400 tons.

Executions amounting to $13,800 were issued at Erie Saturday against the J. E. Patterson Furnace and Galvanizing Iron Works of Erie, Pa. The embarrassment is said to be but temporary and the result of slack business.

J. Painter & Sons Co., of Pittsburg, started its two cotton tie mills on Monday, the hoop mill and the bar mill, which have been idle for some weeks. All except the last named will run on double turn.

LAKE SUPERIOR IRON MINES.

A Duluth dispatch says that a settlement has been made of the Merritt-Rockefeller suit, growing out of the formation of the Lake Superior Consolidated Iron Mines. The original trial at Duluth resulted in a verdict of $940,000 in favor of the plaintiff. The Circuit Court of Appeals reversed the judgment and established a basis for determining damages, if any, on the retrial of the case. Later a motion before the Court of Appeals by the Merritt attorneys for an amendment of the rules for determining damages was denied. Negotiations then began for a settlement, and it is stated that it is based on the payment to the Merritts of $500,000.

The 10 per cent reduction in wages at the Norrie is prompted by the certainty that ore prices will be considerably lower in 1897 than the 1896 price on which former wages were based. The Norrie and East Norrie now have 450 men at work and the Pabst 100 men.

To complete its contract of a year ago, the Drake & Stratton Co. will strip 150,000 cubic yards at the Biwabik this spring.

The work on the new shaft at the Walpole mine, Iron Mountain, Mich., is about completed and the drifting that will follow is expected to open up about 70,000 tons of ore.

The Millie mine at Iron Mountain, Mich., has been closed down and its operation through the coming season will depend upon the extent of the improvement over present conditions. Exploratory work is still kept up.

Negotiations have been concluded for the opening up of the Rouchleau mine which adjoins the Canton at Biwabik. It is possible one shaft of the Canton will be used in getting out ore.

A reduction in wages at the Chapin mine was announced last week, effective Feb. 15. Wages have been on the 1896 ore basis and miners have been able to average $1.93 a day. The company has considerable ore in stockpile, mined at a cost quite out of proportion to what this product will sell for in the coming season. There is no prospect for ore sales as yet, and the alternative of suspending operations was one that the company wanted to avoid if possible. The reduction will average 12½ cents a day through the mine, and office and other salaries are included. The Pewabic mine, also at Iron Mountain, has also announced a reduction in wages and some men have been let out. Some readjustment of wages at the Penn Iron Mining Co.'s properties is also expected.

The Lake Superior Iron Co. at its three Hibbing, Minn., mines is working 350 men, and ore is being hoisted from three shafts at the Hull and from one each at the Rust and Burt. At the Hull and Rust about 3,000 gallons of water are raised per minute, and at the Burt considerably more. No trouble is now experienced from water, and it is thought the new pumps will keep them all permanently dry. The mines have had great trouble since they were opened.

Carnegie Steel Co. Changes.

At a meeting of the board of managers of the Carnegie Steel Co., Ltd., on Friday, Feb. 12, the resignation of John G. A. Leishman as president of the company was accepted and Charles M. Schwab was elected to fill the vacancy. General Sales Agent Alexander R. Peacock was elected first vice president and L. C. Phipps second vice-president and treasurer. Assistant General Sales Agent George H. Wightman succeeds Mr. Peacock, being elected general sales agent. The appointments of Mr. Peacock and Mr. Wightman are effective at once; that of Mr. Schwab and the resignation of Mr. Leishman, April 1, 1897. Mr. Leishman sails early in April for an extended European trip in search of health. Mr. Schwab's successor as superintendent at Homestead is Wm. E. Corey, who has been superintendent of the armor plate department at Homestead.

President Leishman is 40 years old and retires from active service earlier than most of those who have been associated with Mr. Carnegie. He began his career in the iron and steel business with Shoenberger & Co., and later was associated with W. P. Snyder in the iron and steel house of Leishman & Snyder. On Jan. 1, 1887, on the dissolution of the firm he became connected with Carnegie Brothers. The Carnegie Steel Co., Ltd., was organized in 1892, and Mr. Leishman became vice-president; three years ago when Mr. Frick was made chairman, he was chosen president.

The advance of President-elect Schawb has been rapid. He entered the service of Carnegie, Phipps & Co. as a draftsman, under Capt. Jones's superintendency of the Edgar Thomson plant. On the death of Capt. Jones, Mr. Schwab, who had been at Homestead, was transferred to Edgar Thomson; later he returned to Homestead, and has had supervision of the important armor plate operations there. His argument before the Senate Committee on Naval Affairs, in rebuttal of the statements and deductions of Secretary Herbert and Senator Chandler, relative to the cost of making armor plate and at what figure a fair return was possible on the investment, demonstrated his thorough command of the problem. Mr. Schwab is 36 years old.

Alexander R. Peacock, who was advanced recently to a vice-presidency in the company, with the added title of general sales agent, has made a conspicuous record in the sales department of the company, and his attainment of the first vice-presidency of the company is in no sense a surprise.

Personal.

Archibald Winne, Chicago manager of Abbott, Wheelock & Co., sales agent for the Firth-Sterling Steel Co., is mentioned as a prominent candidate for the U. S. Marshalship for the Northern District of Illinois.

Gov. Tanner, of Illinois, has appointed several prominent members of the iron and steel trade on his staff, with the title of colonel. Those honored are John W. Gates, president of the Illinois Steel Co.; John Lambert, vice-president of the Consolidated Steel & Wire Co.; Isaac L. Ellwood, president of the I. L. Ellwood Mfg. Co., of De Kalb, and lately elected a director of the Illinois Steel Co.; Edwin Morton, president of Norton Bros.; W. Dwight Wiman, president of the Union Malleable Iron Co., and Charles E. Bleyer, president of the Hawley Down Draft Furnace Co.

Julian L. Yale, for the past nine years general sales agent of the Illinois Steel Co., has associated himself with Townsend V. Church, who has been connected with the same company in various capacities since 1890. They have opened an office at 1117 the Rookery, Chicago. Messrs. Yale & Church will conduct a general brokerage business on a very large scale, handling all kinds of steel and iron products, but making a specialty of materials entering into railway construction, and with their long and extensive experience in the maufacture and sale of all kinds of railway material, and in the railway business, they have good prospects of success in their undertaking.

Gard Maynard, formerly chief of the order department of the Illinois Steel Co., has been appointed assistant secretary of the company.

Frederick H. Prince, of Chicago, died Saturday of rheumatism of the heart at Clear Water, Fla., aged 48 years. Mr. Prince was a member of the firm of Eaton & Prince, manufacturers of elevators and hoisting machinery.

Rail Buying by Western Roads.

Some of the rail orders placed in the past week can be approximated, though in a few instances the tonnage given is not official. It is reported that the Illinois Central bought 45,000 tons; the C. B. & Q., 30,000 tons; the Rock Island, 25,000; Chicago & Northwestern, 30,000 tons; Chicago & Eastern Illinois, 10,000 tons; Lake Shore & Michigan Southern, 10,000 tons; Northern Pacific, 40,000 tons; Chicago Great Western, 10,000 tons; Grand Trunk, 30,000 tons; Missouri, Kansas & Texas, 10,000 tons; St. Louis & San Francisco, 8,000 tons; Texas Midland, 20,000 tons; Chicago, Milwaukee & St. Paul, 30,000 tons; Atchison, Topeka & Santa Fe, 20,000 tons.

At the next meeting of the Pittsburg Foundrymen's Association, to be held on the 27th inst., Secretary Penton of the American Foundrymen's Association will speak on the "Benefits and Difficulties of Foundrymen's Associations."

W. C. Richardson announces under date of Feb. 10 that owing to the death of H. J. Webb, the firm of H. J. Webb & Co. has passed out of existence and that the vessel brokerage and marine insurance business will be continued by W. C. Richardson at 606-7 Perry-Payne Building.

BEAUDRY POWER HAMMER.

The accompanying illustration shows the latest improvements in the power hammers built by Beaudry & Co., 162 Commercial st., Boston, which present several new features. Chief among these is the manner of imparting to the ram, or head, the force of blow and securing its necessary elasticity of travel. The ram is a steel casting with an internal concaved track. The two spring arms have rolls which bear upon this track. As the hammer shaft revolves these arms lift and throw the ram, which acquires increased travel and force of blow with increased speed of the hammer. At full speed the ram delivers a very powerful blow and returns instantly without reaction or jump. This design overcomes the use of any form of straps or cushions.

The box pillar frame is rigid and occupies small floor space. The anvil is an independent casting with an adjustable shoe-die. The shaft and crank pin run on bronze bushings, and the crank is adjustable for varying lengths of stroke. The steel ram runs in heavy guides cast solid with the frame. It

BEAUDRY POWER HAMMER.

will remain at any position of its stroke when stopped. The force of its blow is under perfect control of the operator and may be of any degree from one pound to the full capacity of the hammer, according to the pressure on the foot treadle. Widely varying thicknesses of metal may be worked between the dies without changing the adjustment of the hammer, and succeeding blows may be struck or the edge on the flat of the work. Full length bars may be worked either way of the dies. In the illustration, which is of a 350 lb hammer, the workman is cutting the end from a four-inch square piece which has been forged by the hammer to the shape shown, in the same heat.

These hammers are built in sizes having heads or rams weighing from 30 lbs. to 500 lbs. They are adapted for a great variety of work varying from very light to heavy forging, axe work, hardware, cutlery, etc. They are also used for drop forging. Beaudry & Co. are making a shipment of eight of these hammers to one hardware company.

A YEAR IN OPEN HEARTH STEEL.

Writing for a recent special number of the *Iron and Coal Trades Review*, London, Mr. Bernard Dawson reviews the progress in open-hearth steel making in the United Kingdom in the year 1896. We make extracts from the article below, giving in full the portion devoted to the Bertrand-Thiel process:

Since the publication of the last special International number of the *Iron and Coal Trades Review*, 12 months ago, the new matters concerning open-hearth practice have come from the chemist rather than from the engineers.

Among the engineering or mechanical advances made is that in the mechanical charging of large furnaces. Machinery for this purpose—actuated by steam, by electricity, by compressed air, or hydraulic power—is now in use at several of the largest and best equipped steel works in the United States, and at such Continental works as Witkowitz. The Illinois Steel Co. have three Wellman machines, and these are being used at Pencoyd, Cambria, the Apollo works, Vandergrift, Lukens Co., Buhl Steel Co., and at the Homestead Works, etc. The practice in America appears to be to have a melter and first helper for each pair of furnaces, as well as the man who works this electrically-driven charging machine. The old practice at some of these American works, as is well known, was to have at least four men to charge each furnace, who not only did this, but loaded up the materials into barrows or bogies in the yard, and brought them up to the furnace doors on the charging-platform level, instead of running railway wagons immediately alongside of the charging platform, as in this country. With these machines one handling of the materials is saved, and the loading of the bogies and barrows can be done by unskilled and less costly labor. Any scrap small enough to go easily through the furnace doors can be handled by the charging machine. One hears nothing of trouble with the motor or machine from the heat from the furnace. With due allowance for depreciation and wear and tear, the published figures obtainable seem to show the prin-

ciple to be one worth consideration in this country, even with our cheaper labor, apart from the time saved in charging large furnaces. The Lauchammer machine and others so exhaustively treated upon by Mr. Schidhammer a little while ago appear to give good results, especially one designed to occupy small space and be within the reach of owners of small plants consisting of only one or two furnaces. The general arrangement of many of our older open-hearth works renders the introduction of a machine which occupies much space quite out of the question.

More attention is now being given by our blast furnace managers to ridding pig iron—intended for basic furnace working more particularly—of sand. Several statements published of late—showing the great percentage of sand sticking to the pig iron delivered to steel works, and the consequent expense, wear of furnace materials, and effect upon the charges—have caused basic steel makers to be more stringent in their requirements under this head. The future will probably show more and more the importance of being able to use a cheap iron—made from Cleveland ores—which has been passed through a mixer to secure a sufficiently uniform metal for it to be used molten direct from the blast furnace—i. e., without the intermediate form of pig iron. How is it to be first desiliconized? Some of our American friends are busy solving this question for themselves. When done, we may be able to get 16 casts a week, perhaps, from a 30-ton basic furnace, with the help of a mechanical charger. A Cleveland iron low in sulphur and in phosphorus would appear to be best, putting on one side the value of the slag for manure purposes; and surely we can somehow get over the mechanical difficulty of the wash of the liquid metal on the furnace hearth.

The published reports of the results attained in Manchester with iron treated by the Stockman process appeared at first sight to be those of some resurrectionized or improved form of the old Heaton process, of which little has been recently heard. The Stockman process is, however, a basic dephosphorization one, and if, in everyday working, a steel can be made in the two and a half hours claimed, from a common phosphoric iron (such as a mixture of Cleveland and Frodingham pig iron), which shall be equal to best Siemens or Bessemer steel, or best Yorkshire iron with no more expensive materials than these and the quantities of iron sand, nitrate of soda, etc., mentioned by the patentee, to stand the tests reported to have been made by Mr. Kirkaldy, it is high time that this process had a trial on a larger and more convincing scale than the small plant at the Ashbury Works was able to afford, although, as in earlier kindred processes, a somewhat more complicated plant is required, consisting as it does, of virtually two distinct processes, viz.: the converter and the reverberatory or open-hearth furnace. Will either mild or hard steel made by this process command a better price than, or as good a price as, good ordinary open-hearth?

The Bertrand-Thiel process, as pursued at Kladno, has attracted some attention in this country lately. The diagrams exhibited at the recent meeting of the Cleveland Institution of Engineers in Middlesbrough are at first sight somewhat alarming involving, as was shown, at least two or three separate and independent open-hearth furnaces to complete the process. These are built on different levels, and are of necessity at some distance apart from one another. In a new works specially designed and arranged to suit this process, no doubt the land required for the disposition or arrangement of these furnaces in series could be devoted to it, and the different levels of the furnaces easily arranged for; but in existing works, even if three existing furnaces were available for this process, we cannot recall one where such three furnaces occupy the necessary relative positions one with another, apart from the question of the levels. From an engineering point of view—which, ofcourse, includes the matters of first cost, maintenance, and up-keep—this system is one that appears to possess very little to recommend it. With regard to the labor, it is not at all probable, at any rate in this country, that the three men ordinarily kept to attend to an open-hearth furnace could or would go from one furnace to another as the metal was run in the spouts, carriers, or landers, from the higher to the lower furnaces. In fact, if the increased output which is claimed as one of the principal advantages of this system is to be maintained, the men would be fully employed as soon as the cast of steel had left the first furnace for the second, and the second furnace for the third, in making the necessary running repairs and getting in the succeeding charges ready for melting again. The first cost of a plant to turn out any given tonnage of steel per shift or per week with this process will probably prove on examination to be more than the increased output will repay. Not only will there be three furnaces to build and keep in repair and to maintain, but, as above stated, there are the extra ground space and the probable extra labor, together with depreciation, interest on extra capital, and the additional cost of buildings, roofing, and other necessary accessories. With such details as the apparent difficulty of maintaining the metal running in the long spouts or carriers from one furnace to the other, from cooling, oxidization, and other troubles, we are unable to deal exhaustively in the present article. Apparently, the capacity of the plant is governed by the amount or tonnage which can be got out of the secondary furnace, and, including the time occupied by the primary and the secondary furnaces in a plant consisting of two furnaces only, more than one of our basic steel makers in this country get the same work out of one furnace in less trouble than double the time that some of the experimental melts at Kladno appear to have occupied with two furnaces. In comparing Continental with British practice, one must not lose sight of the proportions of scrap and of pig iron ordinarily used, and which can be used with any possibility of commercial success. Whether the reduction in the percentage of waste claimed for this process would prove in this country sufficient to compensate for some of the obvious disadvantages, appears to be very doubtful.

The statement has been made that this process is probably the first practical employment of direct pig and ore working. This, however, is scarcely correct, as we have seen such practice in this country regularly; and probably it would be more common were it not that most of the open-hearth steel works here have a quantity of their own scrap, which is not only available, but which it pays better to melt down than to sell elsewhere in the form of scrap itself. If it turn out, after trial in this country, that a gray pig or, say, No. 3 ordinary Cleveland iron, containing the normal or usual quantity of silicon, can be used in the first furnace, there may be a future for it on the Northeast Coast. One must not, however, lose sight of the fact that a process patented, as far as we can remember, nine or ten years ago by Mr. Thwaite and Mr. James Noble, including, among other matters, using two or more furnaces in series, anticipated this process to some extent, although we do not remember that either of the patentees ever gave their own system the exhaustive tests to which it seemed to be entitled. The idea of working with a plant consisting of an open-hearth furnace and a Bessemer converter with a basic lining is certainly not entirely new. It has been claimed for this process that, to give it the best possible trial, as many as six open-hearth furnaces in series should be employed. This would certainly reduce the number of places in which it is likely to be tried in this country to within very narrow limits. It is claimed that a pig iron not only highly silicious, but also highly phosphoric, may be employed; but the particulars of the practice at Kladno which have been published deal with pig iron lower in phosphorus than some of the irons usually available in this country.

As we are now concerned only with the open-hearth process, the value of the Bertrand-Thiel process, with regard to the basic after-blow in the Bessemer process, is not a point that we are called upon to discuss. If this process is to be considered with regard to its being able to deal with molten metal brought direct from the blast furnace, then the question of desulphurizing must be considered, together with the question of whether the present process is the cheapest and simplest one of getting rid of the silicon contained in some of the commoner irons produced by our largest furnaces. There does not appear to be anything specially connected with this process which enables a higher temperature to be maintained in an open-hearth furnace than is usually attainable in the ordinary way. One must not forget that the plan at Kladno, which originally consisted of one 12-ton and one 20-ton furnace, was one in which these two furnaces stood at some distance apart, with one of them at a higher level than the other. This was probably owing to the accidental nature of the site, and in furnaces erected anew for this process the transfer from the first to the second furnace might be made by a ladle, instead

of by the spouts or runners, with very great advantage, and which arrangement might obviate the necessity for having each furnace on a different level from the other. Regarded as a means of working with pig and ore in countries or places where scrap is not available, it may be of importance; but a process that would render it possible to work with a very large percentage of ore in districts or countries where scrap is not to be had, and where pig iron can only be made, on account of unsuitable fuel, at prohibitive prices, would be very much more to the point.

When it becomes possible in this country to obtain pig iron freed from silicon in the objectionable form of adherent sand, the question of being able to use a pig higher in silicon will lose its present importance, to some extent.

The saving in amount (and, therefore, in cost per ton of finished steel) in deoxidizers and recarburizers, is one worth the attention of practical chemists. No doubt, in a plant worked on this system with two furnaces, there should not be very much oxide of iron in the second furnace at the end of the operation. Whether, therefore, a small amount of deoxidizing material will be necessary to rid the metal from "red shortness," is a question that we must leave to be fought out among other minor but not less important details by the chemists connected with our large steel works.

We have been informed that it is proposed, at any rate for the present, to ask a royalty to the patentees of 6d. per ton of steel made. It has been pointed out that the running of molten metal into an open-hearth furnace, brought direct either from a blast furnace or from a mixer common to several furnaces, would possess the disadvantage that, being introduced in one large volume, the metal does not come into contact so gradually and so thoroughly with the purifying agents as it does when it is put in the furnace on the banks in the form of pig iron, which trickles down in small streams by degrees, thereby being gradually and intimately brought in contact with the purifying agents above mentioned. We think, however, that this is not by any means such a disadvantage as can be set againts the advantages claimed by advocates of direct metal, such as the saving of fuel in melting pig, and the labor in handling the metal upon the pig beds of the blast furnaces, breaking it, and charging it into the furnace in pig iron form.

ADVANTAGES OF MECHANICAL STOKING.

The following extracts are made from an article by A. E. Outerbridge, Jr., in the *Engineering Magazine* for February:

No one realizes more fully than the analytical chemist the difficulty of obtaining complete combustion of carbon. It seems an easy matter to thoroughly burn a few grams or grains of powdered carbon in an open platinum vessel when subjected to a white heat; yet such an operation is a tedious one, often consuming hours, and sometimes requiring the use of powerful oxidizing agents. It is not surprising, therefore, that a large percentage of unconsumed carbon passes off from an ordinary furnace, and the fact that bituminous "slack" can now be continuously fed into a fire-box without visible smoke appearing from the chimney-top is a fine testimonial to the mechanical excellence of appliances which so closely approximate the perfection of laboratory apparatus and methods. There are several forms of mechanical stokers designed to practically accomplish this result; but complete combustion does not necessarily mean economical practice. An excess of air over the exact amount required facilitates combustion, but also causes loss of heat energy. The atmosphere, being a mixture of 23 parts of oxygen with 77 parts of nitrogen, will quickly rob the furnace of its heat, if too freely admitted to the burning fuel.

The well-established rules governing the amount of grate surface, proportion of fuel per square foot of grate surface, etc., require to be carefully observed in designing mechanical stoking appliances. Economy of fuel is not the most important consideration in mechanical stoking; in large plants the saving of labor is a much larger item, amounting (according to the calculations of experts who have studied the subject), to 50 per cent, or more, in some cases.

Economy of fuel in successful mechanical stoking results not solely or chiefly from combustion of smoke, but from the more uniform feeding of "green" coal to the furnace, entirely avoiding the opening of fire doors, with consequent drop of steam pressure, etc. Incidental advantages and economies, such as prolonged life of boilers due to regular firing, etc., are claimed by makers of mechanical stokers, and, if there were no offsetting disadvantages, the use of such appliances would, presumably, be universal instead of exceptional. The cost of an effective and durable mechanical-stoking plant limits its application, and the uncertainty as to the actual economy has hitherto further retarded the general introduction.

Economy of operation depends upon many details of construction: (1) Every part of the machine must be readily accessible for repair; (2) the mechanism must be sufficiently simple to be operated by a man of ordinary intelligence, without frequent supervision; (3) the feeding of fuel must be at all times under perfect control of the attendant, so that the fires may be checked or augmented as desired; (4) automatic arrangement for continuously feeding the coal in a thin, even layer, over the entire grate-bar surface, and for constant progressive movement of the body of fuel to prevent formation of clinker, must be provided; (5) the grate-bars and other parts of the mechanism which are subjected to heat must be designed to resist distortion, burning out, and other causes of rapid deterioration; (6) the stoker must be adapted to the use of cheap fuel.

These are the essential qualifications of all successful stokers; there are other features which, though less necessary, add to the utility and convenience, and thus distinguish one form of stoker from another. The possibility of smokeless combustion is clearly shown to be only one factor in the determination of the relative merits of different forms of mechanical stokers. It is, indeed, possible by careful hand-firing, in well-designed furnaces, provided with combustion chambers, dampers, or other appliances for regulating the supply of air, and by constant intelligent supervision, to burn soft coal with comparatively little discharge of black smoke from the chimney; and one of the indirect beneficial results of the introduction of successful mechanical stokers in large boiler plants will, doubtless, be an improvement in methods of hand-firing in small establishments which cannot afford the expense of a mechanical stoking outfit. Thus one installation of a practically successful mechanical stoker in any manufacturing locality serves a double purpose, and the several cities which have passed ordinances regulating smoke discharge are wisely taking the initiative by introducing complete mechanical-stoking appliances at the public boiler plants. It is apparent from the foregoing broad statement of principles of mechanical stoking that durability of machinery and economy of operation are far more important considerations in any appliance of this character than the mere question of first cost.

The principle upon which the mechanical stokers operate is extremely simple. There is usually a hopper or receptacle into which the coal is thrown, either by shovelling or by conveyors; the coal is pushed forward by a continuous or an intermittent movement, into the furnace upon the grate-bars; these are sometimes provided with reciprocating motion, and sometimes made in the form of an endless chain. The coal is spread by various devices more or less evenly, and gradually travels toward the back of the furnace, where a combustion chamber is often provided to complete the burning of the fuel and gases. In some forms the coal is fed underneath the bed by a "worm" or other conveyor, and pushed up through the burning mass at proper places.

Some forms of stokers are adapted to bituminous or coking coal, and others to anthracite fuel. Some are adapted for externally-fired boilers only, others for internally-fired boilers, while still others may be modified to suit varying conditions.

The time is approaching, if indeed it has not already arrived, which was clearly anticipated by a former generation, —a time when the intollerable smoke nuisance in cities where soft coal is used must be abated, if not entirely suppressed. It appears, moreover, that mechanical appliances for accomplishing this object have now been so far perfected that the one-time fear that smoke ordinances would prove impracticable, or, would, at all events, impose hardship upon manufacturers, no longer obtains; on the contrary, it is more than probable that self-interest will lead large industrial establishments to adopt, voluntarily, smoke-consuming appliances as soon as the many advantages of mechanical stoking are made manifest. The object of this paper is to further that end.

WI L PIG IRON EXPORTS CONTINUE?

James Bowron, treasurer of the Tennessee Coal, Iron & Railroad Co., in his recent article in *Bradstreet's* discussing the questions that have come up in connection with the export of Southern pig iron, controverts the opinion that these shipments are likely to cease with the termination of the present season of prosperity prices abroad and of depression prices at home. In the same connection he gives interesting data concerning the development of this business from the first suggestion of such an outlet for Southern furnaces:

"After the sharp pinch of the panic of 1893 reduction in wages, in freight rates, in contractors' profits, and in other available directions led to such a marked decrease in the cost of production that it became evident to those familiar with the markets of the world that there was at least some possibility of competing in neutral markets with English iron. This led to the initiation of correspondence, the shipment of samples, comparing of notes, and the acquisition of information which, during the year 1894, had proceeded so far that business was on the very point of opening up when these negotiations were summarily stopped by the sharp domestic demand for iron commencing in the spring of 1895, which engaged all the time and energy of pig iron producers and gave them a certain profit much more temting than the then uncertain return which might be forwarded by an export trade.

"When, following the Presidential nominations in the summer of 1896, business again assumed a condition of acute depression both as to demand and necessarily also as to prices, the negotiations which had been dropped early in 1895 were resumed and speedily began to mature. A few small lots of iron were shipped experimentally to England and Italy and Spain, leading to larger orders as the quality of the iron was found to be in every respect equal either to that of Middlesbro producers of 3 and 4 foundry and gray forge iron, or even to the well-known producers of Scotch foundry iron. The proportion of phosphorus in the Alabama pig iron is practically only half that of Middlebro and the shrinkage correspondingly less, other ingredients being substantially the same, while in contrast with Scotch pig the 'soft' iron (high silicon) produce in Birmingham answers in every respect the purposes and can be furnished to the consumer for less money.

"Necessarily the commencement of such a commerce has been subject to drawbacks, the chief of which has been the scarcity of freight room on ocean going vessels. This difficulty is being overcome to some extent, as the tide of cotton, grain and miscellaneous exports from Southern ports has become so pronounced, and the steamers frequenting South Atlantic and gulf ports have learned the rapidity with which any quantity of pig iron, from a few hundred tons up to a cargo, can be furnished from Birmingham at low ballasting rates, in case of need, and the carrying of this iron does not preclude thehandling by the steamers of all the lighter, more bulky and more profitable articles which would otherwise have been open to their engagement, but does stiffen the vessels and add to their safety and comfort in their trans-Atlantic voyages.

"It is within my personal knowledge that Alabama iron is now being shipped to England, Holland Belgium, Germany, Spain, Italy, Austria, India and Japan, with business pending for Russia, Australia and South Africa. It is not easy to speak of figures without interfering unduly with private business affairs, but I am able to state that the aggregate export sales of Alabama iron from July 1, 1896, to Feb. 1, 1897, are more than 92,000 tons. The statement recently made in a prominent metallurgical journal in New York that these claims were not borne out by the government figures of exports to Oct. 31 is beside the mark. These sales have been made in an increasing ratio and will require three or four months from the present time to complete them. It is probably true that the shipments of Birmingham iron within the past week to foreign countries have been greater than the whole of the shipments combined which were made prior to Oct. 31, and included in the government returns above referred to. I am permitted to state that the foreign sales of the largest producers in this district in the month of December, 1896, and January, 1897, have been larger than their sales for domestic consumption.

"As to the future of this business it is not so easy to speak specifically. The prices of iron in England and in Germany are higher than they have been for nearly seven years, and they have at one time within the past fourteen years been as much as $1.75 per ton less than they are to-day. On the other hand, the sales which have been recently made are realizing to Alabama producers nearly $1 per ton more than those which were made last summer, when negotiations were first entered into, so that at the prices then prevailing it wouldbe possible to lay down American iron in competition with English if the prices of the latter were to recede within 75 cents per ton of the lowest on record. This difference, however, would be sufficient to justify the discontinuance of the movement, if it could be maintained; but, on the other hand, in favor of the Birmingham shipper is the fact that this business has heretofore been done at delivered prices below the parity of those prevailing in England and on the continent of Europe, such prices having been made, as is usual in a new market, for the introduction of unknown brands. It is reasonable to suppose that with the benefit of a full familiarity with American iron on the part of the European consumers they will be willing to pay the full market prices, and, judging from the considerations previously mentioned, Ithink it will be possible to continue the business even when foreign prices again recede.

A METHOD OF SAMPLING IRON ORES.

Some months ago, when chemist for the Missouri Furnace Co., of St. Louis, I was sent to Iron Mountain, Mo., to sample certain piles of jigged iron ore. This ore varies from particles the size of sand to lumps as large as hickory nuts. Former experience with this ore had taught me that it would be practically impossible to get an average sample of each pile by tunneling in the usual way. The ore had laid for years, exposed to the elements, and the outside alone would show a different analysis from that which was inside and partially at least protected from weather influence. To move the pile was, of course, out of the question, but I hit upon a plan which gave, I think, as reliable results as could be attained in any way. I experimented with iron pipes, by driving them into the ore piles. Trial showed me that for this ore a two-inch pipe gave the best results. The first pipe used lasted for the boring of only five holes, the sledge upsetting the end of the pipe badly, causing it to crack on the weld.

The noon following my first morning's work, I had the blacksmith make a collar and pin, for a new section of pipe. The collar was made of three-eighths inch iron, one inch wide, and was shrunk on the outer end of the pipe; the object being to protect the pipe. The pin, or plug, was also made of iron and should comfortably fill the pipe for about six inches. A shoulder on the pin transmits the blow of the sledge to the pipe. I used a pipe 13 ft. in length and drove it 12 feet deep at intervals of 10 feet into the ore piles. Two men using six-lb. sledges could drive 25 holes a day in this ore.

To draw the pipe from the pile, where I could do so, I used a mule. In places where the mule could not go, the pipe was pulled by two men. A stout chain, with a ring on the end slipped over the pipe, facilitated matters. The ore will core in the pipe, and, after drawing, by raising the pipe to a vertical position, it was easily removed by a few raps on the pipe with a hammer. By this means a continuous sample was obtained, and the correct proportion of coarse and fine materials was kept. I also used a pipe with marked success sampling fine jig ore. This ore resembles sand in degree of fineness and was the product of bumping tables.

Some care must be taken in drawing the pipe, particularly when it has been driven downward, as in that case sudden starting will cause part of the ore to remain in the pile. I found, by exercising caution, I could draw the pipe at an angle of 30 degrees and be sure I got all my core. With a very wet, fine ore, the pipe could be driven downward on a much greater angle.

With my acquaintance with Mesabi ore, it seems to me, some such method would be very applicable for sampling, both in the mine and for car lots. I see on reason why ores of other metals, which are in a similar mechanical state, cannot be sampled in this way. Also cements, clays, etc. I personally lay great stress on accurate sampling, for if your samples are wrong, the subsequent chemical results are worse, for they are misleading.—[W. W. Taylor, in Engineering and Mining Journal.

A POINT IN FOUNDRY MANAGEMENT.

I have seen a first-class molder lose a piece several days in succession simply because he was required to do the work in a certain way by the foreman. The foreman in this instance was also a first-rate molder. How difficult it is to impart instruction in molding. Your way is not my way, and mine is not yours. When you tell me not to ram hard, how hard do you mean? Or, if you say, "Use a large riser or feeder," do you mean a two-inch or a four-inch diameter? In speaking of the temper of green sand, what do you mean by wet or dry? What would be exceedingly wet for a close, clayey sand would be rightly considered dry in a coarse, porous sand.

The truth is, when a foreman undertakes to multiply himself by the number of workmen in his employ he fails. And he ought to fail. The man whose contempt for his fellow workmen is so extreme that he will try to warp their minds always into his own mental groove is, to say the least, making a very great mistake. He can never be a foreman of the highest order until he is cured of this folly. But, in justice to the foreman, let it be said that this practice is not always of his own motion. This practice is very recent in origin. In fact, it began some fifteen or twenty years ago—about the time that the brilliant idea took possession of employers generally that one good mechanic in the foundry for foreman was enough. And the idea seemed to work very well in practice for a number of years, or until a large majority of the generation of competent molders were worn out, and then (which is to say now) they do say that there is a very provoking scarcity of good molders to be found.

There is no disguising the fact that iron molding has undergone very disastrous decadence in many foundries in the past few years. In the old days, to be a molder meant that the foreman was never to tell you how to make a casting, but simply to tell you to make it. His instruction was to the apprentices and to any molder who might ask for advice, and an occasional straightening out of a man who was obviously going crooked. The molder was proud of his mechanical ability. The product of his labor was his product. He was himself an entity, and possessed therefore that self-esteem which spurs a man to effective achievement.

If you wish to make a man utterly incapable and insufferably lackadaisical, just tell him that you know it all and that he has but to do as you instruct. If he loses a casting, whose fault is it? Not his, of course, because he followed or tried to follow your instruction. If his product is good, it is no credit to him as a mechanic, but simply as an interpreter of your precepts.

To do something useful by the powers that are within us solely is an act second only to that of creation. Every man believes himself capable of doing great things, and his belief is founded in fact, and he will justify it if you but give him a fair chance.

The desideratum, then, is to so conduct the factory as to develop in the fullest measure the highest abilities of each man in it. And this can never be done unless each individual is held responsible for the quality of the product of his own labor. Let every condition of his life in the factory be friendly to moral and physical health, and mental growth, and the mechanical results will accord with the quality of the man.

To conclude; the foreman who minutely instructs his workmen in practice, thus assumes responsibility for results that are beyond his control, while he who permits the largest possible liberty in practice, advising only where necessary, makes his workmen responsible for the results and gets the best there is in them accordingly. To know when not to give advice is as important as to know when to instruct.—[Mechanical World, Manchester, Eng.

No. 2 furnace of the Dunbar Furnace Co., of Dunbar, Pa., which was blown in Feb. 1, is eclipsing all former records. The fuel used from the time the furnace was started has been by-product coke exclusively, of which the company has a stock of over 6,000 tons on hand, which, in conjunction with the daily product of their 50 Semet-Solvay ovens, will keep the furnace running for several months to come on by-product coke alone.

WHY AMERICAN MACHINERY LEADS.

American makers of machine tools have long been active and formidable competitors in the markets of Europe, but the recent invasion of England with tools for making bicycles, especially by the Pratt & Whitney Co., has caused something like alarm. Many special tools made by that firm were exhibited at the recent National Cycle show and attracted much attention because of their accuracy, their efficiency, and the ingenuity of their design. One of our English contemporaries devotes several pages in two different issues, to descriptions of some of these tools, and says that the Americans are reaping a rich harvest by selling, pretty well at their own price, special cycle-making tools which cannot be bought of British makers. The editor undertakes then to explain why the American has shown so much more promptness and originality in seeing and meeting this demand. He thinks it evident that the English mechanic could have made the machines if he had thought of them. But why did he not think? That seems to be largely a sociological matter. The control of English works, making machine tools, is largely in the hands of prosperous men who send their sons to schools where mechanical ingenuity is unhonored and where the important knowledge seems to be the polite branches of learning. The young man so trained passes a little time in the shops, where he sees designing entirely in the hands of subordinates, and where the notion is confirmed in his mind that designing is a subordinate part of the work of the concern; and so he gradually takes the business control of the establishment with such theories well fixed in his mind.

Furthermore, those makers of machine tools now active, who began in the shops and worked up by their own good qualities of mind and character, are not now suited to take a leading place in their business for want of the broader education which the modern mechanical engineer gets. On the other hand, the English editor is disposed to think that the democratic customs and habits of our people result in the eventual control of the works by men who have knowledge of and sympathy with the men in the drafting-rooms, and the mechanics in the shops, because they played with them as boys and sat by their sides in the public schools, and have the habit of treating them as intellectual equals. Consequently, ability as a draftsman, a designer and a machinist has higher rank here than on the other side of the water, and the men who have this ability have more to do with directing the policy and the daily practice of the shops. Perhaps this is all true. At any rate, it is an interesting speculation, and it is gratifying to think that American industry has taken so high a place abroad as the result of applied skill and sound business methods.—[Railroad Gazette.

According to the statistics collected by the Association of German Iron and Steel Manufacturers, the production of pig iron in the German Empire (including Luxembourg), during the year 1896, was 6,360,982 metric tons against 5,788,798 tons in 1895, showing an increase over the total output of the previous year of 488,194 tons, or 8.43 per cent. In 1895, the increase over 1894 had been only 84,463 tons, or about 1.5 per cent, and in 1894, the increase over 1893 amounted to 284,035 tons, or 5.43 per cent of the total output.

It is stated that a company of Beaver Falls capitalists is securing options and estimates looking toward the erection of an electric power plant, the power to be generated by falls in the Beaver River. Among those said to be interested are Frank R. Pearson, W. A. McCool, S. P. White and H. W. Reeves.

The Pennsylvania Steel Co. has received large orders for rails for the Boston & Maine Railway, and the West End Street Railway, of Boston. The rails of the latter purchase will be used to construct the company's tracks through the subway under Boston Common.

The Westinghouse Machine Co. has sold to the Tennessee Centennial Exposition Co., four Westinghouse compound engines, each 400 h. p. The engines will be installed in the exposition company's power plant.

ECONOMICS OF ELECTRICAL TRANSMISSION.*

BY WALTER DIXON.

Until quite recently it seems to have been the custom, in bringing electrical subjects before such a society as our own, to have premised one's remarks by going into various formula and detail relative to the calculation of electrical powers, and to describe the various modes of construction and manufacture of dynamos and electric motors.

That it is hardly necessary to do this at the present time is probably one of the many indications that electrical machines have come amongst us to stay, and that a sufficient knowledge of their working and capabilities may be considered general.

While electricity for lighting purposes is being generally applied in works of any importance, its adoption for motive power purposes is, with us, yet in its infancy.

Owing to certain reasons, iron and steel works up to the present time have probably made as little use of electrical driving as any of the industries, though there are indications that this will not long continue, and the fact that the New Duquesne Steel Works & Blast Furnace Co., in America, have largely adopted this class of power will probably be an incentive to the further application of it in our own country.

I have during the past few years spent some months on the Continent, and have gone over in detail some 40,000 to 50,000 h. p. of electrical power plants, including probably four-fifths of the installations which have formed the subject of papers, or have received notices at the various British institutions which have interested themselves in this subject.

It is estimated that there are now at least 500,000 motors, distributed over 10,000 installations, at work in America, and some 15,000 h.p. in New York alone; and the largest installation in the world has lately been erected at the Niagara Falls, which, although at the present time only generating 20,000 h. p, is arranged and will probably in the near future develop into a station giving off 50,000 h. p.

While we as a nation are theorizing as to whether it is practical, other countries are using electrical driving, to their own profit and to our disadvantage As an instance of this, it was only last year that we saw machinery for the Falls of Foyers, which could quite well have been made here, being manufactured on the Continent in a works which was driven wholly by electricity, and we have visited several similar Continental mills and factories which are actively in competition with ourselves and exporting machinery to this country.

I remember in the early part of last year being in a newly arranged factory on the Continent which has recently cut us out in several of our markets, and this very largely due to a much reduced cost of manufacture, owing to their improved electric method of power driving, their coal consumption alone being from half to one-third less than any of the competing companies in this country.

There is no doubt, of course, that we, with our older works and factories, are very diffident to throw out such working plants as we have, especially in these hard times; and it is in countries where new works are constantly being erected, and where the most modern machinery is being installed, that advantages are obtained over us.

Meanwhile, it is obvious that in countries where all modern methods of driving and transmission of power are thoroughly well known and understood, and where they have the option to choose as they will, electric driving is being largely adopted in preference to other methods, and to the methods which are with us in general use.

The general method for distributing power in an iron and steel works can be resolved into two systems:

1. The placing of large engines centrally in the works, and by means of belting, shafting, pulleys, gearing, etc., transmitting the power to the various departments in close proximity.

2. Carrying steam by piping either overhead or underground, to numerous small engines driving various machines scattered through the works.

It is acknowledged that these are extremely extravagant methods, only a very small proportion of the power generated at the boilers being used in actual work. They are, however, well tried and established, and were it not for the advent of the electric motor might still go unchallenged.

* Abstract of a paper read before the West of Scotland Iron and Steel Institute, December 18, 1896.

Dealing first with the question of transmission through shafting and gearing, Flather, in his book on the dynamometer, gives the following results of tests made in several factories in America, showing that the power required to drive the shafting alone varies from 15 to 80 per cent of the maximum engine power, and an average in the ten cases cited below of 38.6 per cent:

TABLE I.—HORSE-POWER FRICTION.

Name of Firm.	Nature of Work.	Horse Power. Tot'l.	Req. to drive shftg	Req. to drive mchy	Per cent to drive shftg
J. A. Fay & Co	Wood-working machinery	100	15	85	15
Union Iron Works	Engines, mining machinery	400	95	305	23
Frontier Iron and Brass Works	Marine engines, etc	25	8	17	32
Baldwin Locomotive Works	Locomotives, etc	2,500	2,000	500	80
W. Sellers & Co	Heavy machinery, etc	102.45	40.89	61.56	40
Pond Machine Tool Co	Machine tools, etc	180	75	105	41
Yale and Towne Co	Cranes and locks, etc	130.05	66.81	68.24	49
Ferracute Machine Co	Presses and dies, etc	35	11	24	31
Bridgeport Forge Co	Heavy forgings etc	150	75	75	50
Hartford Machine Screw Co	Machine screws etc	400	100	300	25
	Averages	346.4			38.6

Coming nearer home, we take from Alderman Richardson's presidential address before the Northeast Coast Institution of Engineers and Shipbuilders particulars of tests which he made, giving results which practically amount to the same figures.

In this case eight engines (generally smaller than those taken by Flather) arranged for driving shafting were indicated, the fractional losses varying from 25 to 70 per cent, and averaging 43 per cent of the working load:

TABLE II.

Engine.	Length of shafting in feet.	Number of Pulleys.	Length of belts in feet.	I. H. P. Loaded	I. H. P. Light.	Loss Per Cent.
No. 1	370	153	4,292	48	17.2	35.8
No. 2	782	113	2,263	93.9	23.4	25
No. 3	515	283	3,582	44	20.2	46.2
No. 4	571	335	4,831	28.9	15	52
No. 5	691	79	1,401	56.2	20	35.6
No. 6	381	22	464	75.7	22.8	30
No. 7	117	49	1,210	9.3	6.5	69.9
No. 8	242	70	1,429	15.6	7.8	50

These results, he mentioned, had been confirmed by Mr. Westgarth, who "found in an engine and boiler works in which he had experimented, that of the total power developed by the steam engine 59 per cent was absorbed by the shafting and gearing, and in one of the workshops where two long lines of shafting were used for driving a comparatively small number of machines the power absorbed was 65.6 per cent of the total. In another workshop where the shafting was well laid and rope gearing used for the main drives, the percentage was 42."

These figures receive additional importance when it is remembered that this power to overcome friction (which is such a large percentage of the whole) is constant from the time the engine is started until work is stopped, no matter how little or how much power is being expended on actual work.

Assuming the case of a 100-h. p. engine, 40 per cent of which is absorbed in friction when loaded, and that the average working load is three-quarters of the maximum, we have the following figures:

	Horse Power.
Total power of engine	100
Average working load	75
Power absorbed in friction =	40
Power absorbed in work =	35

showing—(*a*) power absorbed in friction, 53.3 per cent of the total load; (*b*) power absorbed in actual work, 46.6 per cent of the total load.

Similar results are mentioned by Mr. Adamson, who, in a paper read before the Manchester Society of Engineers, states that from tests made in his own and other works they have found that quite 60 per cent of the normal working load was absorbed in frictional losses.

Coming next to the system of conveying steam direct from the main boiler to the various small engines scattered about the works, it is at once obvious that this method cannot be expected to give economical results, from the following among other reasons:

1. The engines are of a type which do not admit of any fine adjustment, valve regulation other than that of the stop valve being as a rule out of the question.

2. The cylinders are usually proportioned so as to be large enough to do the maximum amount of work that may ever be required of them, no account being taken of light loads.

3. The engine being situated at more or less distance from the boiler, the steam in the pipes is always subject to condensation.

4. The engines must, especially in cold weather, be kept constantly running, even when no work is being done, to prevent injurious condensation in pipes or cylinders.

5. Steam joints, both in engines and pipes, are troublesome and often leaky.

We have recently had under our notice a typical works in which punching, shearing, and bending machines, etc., were placed at distances varying from 120 to 200 yards from the boilers. The coal consumed per day of 9 hours was 5,900 lbs. Taking the actual horse-power of work done at 40, and assuming an evaporation of 6 lbs. of water per lb. of coal, we have it that these engines, which, it is estimated, run for about five hours per day, require 177 lbs. of steam per horse-power hour.

Alderman Richardson has also given particulars with reference to the steam consumption for the eight engines previously mentioned, these being of a larger size than those just referred to, and doing constant work. They were supplied with steam at 60 lb. pressure, and were place at various distances from the boilers, in one case about 700 feet away.

He mentions that the consumption of steam averages 50.9 lbs. per indicated horse-power hour, and to this he adds seven per cent for condensation in the steam pipes, bringing the total up to 55 lbs. per indicated horse-power, or say 73 lbs. per actual horse-power, which he states is by no means exaggerated, as it is possible the condensation in the pipes exceeds that indicated by the traps.

These two sets of conditions, being those common in our iron and steel works, may be summarized thus:

(*a*) Machinery driven through belting and shafting requires an expenditure of say 40 to 60 per cent of the power actually used, to overcome frictional losses.

(*b*) Engines of moderate size, say to 50 horse-power, receiving steam from boilers at a distance, require say 60 to 80 lbs. of steam per horse-power hour.

(*c*) Small engines scattered about works, fixed direct to machines, require from 100 to 200 lbs. of steam per horse-power hour.

In the case of machine and other shops situated about works, we have in many cases a combination of the two conditions *a* and *b*.

Using our previous illustration, which showed:

	Horse Power.
Power absorbed in friction	40
Power absorbed in actual work	35

And assuming steam consumption per horse-power of, say, 70 lbs.,—then $70 \times 75 = 5{,}250$ lbs. of steam for 35 horse-power of actual work, = 150 lbs. of steam per horse-power.

Situated as we are in the center of the coal district, the question of consumption has hitherto been considered in a less degree than is warranted, though it is daily being felt to be of more importance.

That the results above shown can be immeasurably improved by the application of electricity has now been proved too often to admit of doubt. Assuming that the power can be concentrated at one point and that the electric generator is driven from a high-class engine, either direct coupled or by belting, we can obtain the following results:

Efficiency of generator:

	Per Cent.
At full load	92 to 94
At half load	88

Efficiency of conductors at distances up to say 400 yards from the generating station:

	Per Cent.
At full load	93
At half load	98

Efficiency of small motors up to say 10 horse-power:

	Per Cent.
At full load	85
At half load	78

Efficiency of large motors up to 50 horse-power:

	Per Cent.
At full load	92
At half load	88

These conditions combined give an efficiency:

	Per Cent.
At full load of	72
At half load	67

Assuming a consumption of say 20 lbs.. of steam per indicated horse-power, we have at half-load with an efficiency of 67 per cent a consumption of say 27 lbs., including all the losses, and at full load with an efficiency of 72 per cent say 25½ lbs., or say 36 lbs. and 34 lbs. respectively per actual horse-power when employed in small motors not exceeding 10 horse-power each.

There is another factor which must not be overlooked, viz., that in considering power given off electrically the arrangements are such that the motors can be readily stopped and started, and that the electrical generator has in itself the initial function of an engine governor, i.e., its output at all times depends on the amount of work required of it, so that at no instant is there any waste by over production. This is an important matter, and in great contrast to the conditions under which power is transmitted through shafting and belting, in which whole lines of shafting have to be run, and the whole friction load expended, though perhaps only a few machines may be required, or where engines have to be run constantly to prevent harmful condensation.

A consideration of these conditions will show that the old methods involve: *a*. Excessive capital expenditure in providing abnormally large steam generating plants. *b*. Excessive coal consumption. *c*. Proportionately heavy standing charges in handling excessive quantities of fuel. *d*. Additional engine, boiler and machinery attendants. *e*. Excessive maintenance and repairs involved in the upkeep of numerous engines, shafting, gearing, belting, brasses, steam pipes, etc. more or less constantly in use, whether much or little work is being done.

With electrical transmission, these items are largely eliminated or reduced to a minimum, the conditions being that not one pound of fuel need ever be burnt or one horse-power ever expended, except when doing actual remunerative work. That this is not imaginary has been repeatedly borne out and amply illustrated, and especially so in the case of an experimental plant for driving outlying machines, similar to those of which we haeve been speaking, which was erected in the North of England, and to which reference has often been made. The cost of this installation, which is about 40 horse-power, was approximately £1,000, the whole of wich sum was saved in less than one year by reduced coal consumption and boiler attendance.

THE case of the United States against Southern cast iron pipe companies, argued in the United States Court at Chattanooga recently, has been decided. The opinion handed down exonerates the defendants and dismisses the petition. The court finds that the association among defendants did not create a monopoly or combination in restraint of trade under the anti-trust act, as alleged, and that the bonus which it was charged was added to the fair price of pipe was only an arrangement among defendants, which did not affect the price of pipe to the customer; that while in certain instances pipe had been sold for higher prices, the price was generally fixed by outside competition, and no complaints of the price had been made. District Attorney Bible will enter a petition at once for a new trial, and the case will be heard before the Circuit Court of Appeals at Cincinnati the first Monday in March.

S. C. MUNOZ, for some years special sales agent for the Heine Boiler Co., and for the past year general sales agent for the Edgemoor boiler, has associated with himself in business Mr. E. C. Darley, late of the Rankin & Fritsch Engine Co., of St. Louis, and previous to that associated with J. P. Witherow, the well known steel works builder. These two have formed a new firm under the name of Munoz & Darley, with offices in the Rookery, Chicago. They will act as the general Western representatives of the Cahall vertical and Cahall-Babcock & Wilcox boilers, manufactured by the Aultman & Taylor Machinery Co., of Mansfield, O.

THE estimated output of Connellsville coke in the week ending Feb. 6, was 97,617 tons from 9,870 active ovens. Plants operated by furnace companies are running full.

WHETHER TO BUY OR NOT TO BUY

A COCHRANE SEPARATOR?

Whether 'tis wiser to select a strong construction—a compact shell of the form next strongest to a perfect sphere, and in this oblated sphreoid have distinctly placed a firm and rigid baffle which by its very adaptation to the purpose sought so impedes the forward journey of the water to the engine bent that this element which from the steam has come—no longer seeks to follow its elastic carrier which, by courses wisely judged for size and place, smoothly passes on to its accustomed work, scarce noting that its burden has been left behind.

That these are truths depends not on the telling, for were these appliances to men of note unknown then might you our veracity impeach, but as it is some fourteen hundred odd of them are used, and customers courteous and pleased have vied with us in making known their fame.

WHAT HO! THE QUESTION.

HARRISON SAFETY BOILER WORKS,

PHILADELPHIA, PA.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

The Erie Scale Truck Co., Erie, Pa., has been chartered for the purpose of manufacturing motors, engines, etc. The officers are: President, H. N. Fleming; vice-president, C. N Reed; secretary, C. A. Butt, and treasurer, F. W. Bacon, and the capital stock is $25,000.

The Keystone Gas Engine Co., of New Brighton, Pa., has been incorporated with a capital stock of $25,000. The directors are: Milo A. Shoemaker, Charles W. Shoemaker, Beaver Falls, and William B. Wallis, Pittsburg.

The Olin Gas Engine Co., of Buffalo, N. Y., has been incorporated, with a capital of $50,000, and the following directors: Fred C. Olin and William R. Cornell, of Buffalo, and Harvey J. Hopkins, of Pleasantville, Pa.

The Shaw Steel Casting Co. has been incorporated at Milwaukee, Wis. with a capital stock of $5,000 by M. Abraham, Solomon Shaw and Louis V. Shaw.

The Keystone Gas Engine Co., of New Brighton, Pa., has been chartered with a capital of $25,000. The directors are: Milo A. Shoemaker, Chas. W. Shoemaker, Beaver Falls; Wm. B. Wallis, Pittsburg.

The Cresson (Pa.) Electric Light Co. has been chartered with a capital of $10,000.

H. E. Gray, Columbus, N. C., will buy a drill press.

J. M. Martin, 314 Central ave., Knoxville, Tenn. is in the market for cook-stove patterns.

Henry M. Priest, formerly president of the Junction Iron & Steel Co., Mingo Junction, O., and now an attorney at Steubenville, O., is associated with a number of Steubenville capitalists in the purchase of the works of A. Northrop & Co., South Side, Pittsburg. Possession was given last week immediately after the purchase and the new company will continue the manufacture of sheet roofing, making a specialty of decorative steel ceilings, controlling a number of patents for this product. About $25,000 has been invested in the plant. Mr. Priest will continue in the practice of law at Steubenville.

Additions, Enlargements, Removals, Etc.:—

The Riverside Iron Works, Wheeling, W. Va., are about to erect an additional plate mill to their Benwood plant, which will be uniform in size and rolling capacity with their other mills.

The Laughlin Nail Co., Wheeling, W. Va., with a plant at Martin's Ferry, O., manufacturer of cut nails and tin and terne plate, will make additions and improvements to its tin plate plant costing $20,000. There will be added a new tin mill, three new tinning pots, a new annealing furnace, new shears, and an iron addition 40x70 feet and a brick addition 48x110 feet. The plant has run full capacity for several months.

The Shoenberger Steel Co., of Pittsburg, is adding to its plant a new shop 208x178 feet, which will cost $13,750.

The George F. Blake Mfg. Co., Cambridge, Mass., is to make an addition to its blacksmith shop, also to one of its machine shops.

The Junction Iron & Steel Co., of Mingo Junction, O., will, in the near future, add two or more additional finishing mills.

New Construction:—

The structural work has just been completed at Johnstown, Pa., on the two immense Gantry cranes designed for the Cambria Iron Co., by the Wellman-Seaver Engineering Co., of Cleveland. The steel was furnished by the Cambria Iron Co., and Riter & Conley, of Pittsburg, have done the construction work. Details of the cranes, each of which has a span of 200 feet, were given in *The Iron Trade Review* of Dec. 3. The cranes will handle the material stored and loaded in the yard of the company's new structural mill.

The Penn Bridge Co., of Beaver Falls, Pa., reports having received the award of contract for buildings for the naval station at Port Orchard, Puget Sound, Washington. These buildings comprise a storehouse, 60x120 feet, with a height of two stories, with steel floor girders for the second story; also a construction and repair shop 67 feet wide and 325 feet long with a gallery extending around both sides and ends, with steel floor construction for the same. The buildings are to be erected the coming spring and summer.

The Keystone Gas Engine Co., of New Brighton, which has been granted a charter, will shortly erect extensive works at that place.

The buildings of the Missouri Frog & Crossing Works, at Centropolis, Mo., recently destroyed by fire, will be rebuilt.

The Rich Patch Iron Co., of Buena Vista, Va., contemplates erecting a modern blast furnace near Covington, Va., at an early date.

The Blue Ridge Manganese & Iron Co., of Staunton, Va. will, it is said, erect a charcoal blast furnace.

The Firth-Sterling Steel Co., McKeesport, Pa., has begun the erection of two new buildings to replace the treating-house and machine shops recently destroyed by fire.

The nucleus of a fund of $100,000 for a tin plate mill has been started by the Johnstown (Pa.) Board of Trade. Harry Rosensteel, of Johnstown, heads the list with $25,000.

J. S. Connell & Son, of Philadelphia, will soon begin the erection of a pattern shop, two stories and 107x20 feet.

Lang & Shaarman, Marshfield, Wis., propose to build a foundry and machine shop for the purpose of increasing their facilities in the manufacture of farm implements.

Fires and Accidents:—

The foundry building of the Link Belt Machinery Co., 39th st. and Stewart ave., Chicago, was partly destroyed by fire Feb. 10, causing a loss of $25,000.

At Chattanooga, Tenn., Walsh & Weidner's Boiler Works burned with loss of $8,000.

Geo. W. Miller & Son's machine shop at Loys, Md., was destroyed by fire.

George Smith's Iron Foundry, 169 to 177 2nd st., Jersey

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO.,

Proprietors of the CELEBRATED Mount Savage Fire Brick

GOVERNMENT ‡ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

The First Manufactory of its Kind in the U. S.

Home Office and Works:—MOUNT SAVAGE, Alleganv County, Md.

Branch Offices:—No. 1 Broadway, New York; N. Y.; No. 222 So. Third St., Philadelphia, Pa.; Fergusen Block, Pittsburgh, Pa., Stowe, Fuller & Co., 195 Merwin St., Cleveland, Ohio.

DUCTILE CAST IRON

TENSILE STRENGTH 60,000 LBS.

HOMOGENEOUS, SOLID AND CLEAN.

HIGH ELECTRICAL PERMEABILITY.

EAST CHICAGO FOUNDRY CO., 716 THE ROOKERY, CHICAGO.

Subscribe for the Iron Trade Review, $3 per year.

EDWARD E. ERIKSON,

CONSULTING AND CONTRACTING ENGINEER.

Steel Plants, Sheet and Tin Plants, Gas Furnaces and Producers Structural Iron and Steel.

Automatic Billet Heating Furnaces. Plans and estimates furnished.

CONESTOGA BLDG., PITTSBURG, PA.

Stowe, Fuller & Co.

WESTERN AGENTS OF

Mount Savage and Queen's Run Fire Brick

The leading BRICK of this country.

MANUFACTURERS OF

OHIO FIRE BRICK. ALL SHAPES IN STOCK.

The largest shippers of FIRE BRICK in the West.

Warehouse and Docks: 185-193 Merwin Street

CLEVELAND, OHIO.

THE SARGENT COMPANY.

OLD COLONY BLD'G. CHICAGO ILL. U.S.A.

ST. PAUL, TACOMA, PORTLAND, ST. LOUIS, CINCINNATI, SAN FRANCISCO.

OPENHEARTH STEEL CRUCIBLE CASTINGS.

City, N. J., has been damaged by fire to the extent of $15,000. The foundry building was destroyed and the machinery badly injured.

McMinnville Foundry & Machine Works, McMinnville, Tenn., owned by T. H. Eastwood, was burned on Feb. 3, with a loss in patterns and machinery of about $5,000, mostly covered by insurance.

General Industrial Notes:—

Wm. Jessop & Sons, Ltd., manufacturers for over a century of Jessop's steel, have in preparation and will shortly issue from their chief American office 91 John st., New York City, a new edition of their catalogue. The book will be attractively gotten up and illustrated, and will contain full information regarding the Jessop product. It is intended for gratuitous distribution among users of high grade steel for every purpose.

The Spang Iron & Steel Co. resumed operations in its Etna, Pa., plant last week after a shut down of several weeks.

Moorehead Bros. & Co.'s Sharpsburg, Pa., plant resumed last week after three weeks' idleness.

The Totten & Hogg Iron & Steel Foundry Co., manufacturer of tin mills, rolling mill machinery and engines, Pittsburg, just received an order from the American Tin Plate Co., at Elwood, Ind., for three 24 in. hot mills complete. It has also received orders from different parties in the last two weeks for 190 tons of chill rolls.

The Tudor Iron Works, at St. Louis, started up this week with a force of 500 hands.

The Pittsburg Tool Steel Co. started up its plant at Greensburg, Pa., this week.

Henry R. Worthington has just been awarded a contract by the city of Chicago, covering six vertical triple expansion direct acting high duty pumping engines, each of 20,000,000 gallons daily capacity. This contract amounts to $437,600, and is the largest contract for water works pumping machinery ever placed in this country. The above six engines each have a daily pumping capacity of 20,000,000 gallons against a head of 150 feet, and will be supplied with steam at a pressure of 140 lbs. to the square inch. The engines will each be of 530 h. p. This company is also building three verticle triple expansion direct-acting high duty pumping engines for the city of Brooklyn, N. Y., under a contract amounting to $385,000. These engines each have a daily capacity of 20,000,000

U. BAIRD MACHINERY CO.

Iron and Wood-working Machinery, Small Tools and Machinists' Supplies.

123 AND 125 WATER STREET, **PITTSBURG, PA.** 124 AND 126 FIRST AVENUE.

LIST OF SECOND-HAND TOOLS:

1—24x24x7 ft. New Haven Planer.
2—16x18 in. Lathe & Morse.
1—15 in. Hendey Shaper.
1—15 in. Yungst Shaper.
2—No. 1 Brown & Sharpe Screw Machines.
1—No. 1 Garvin Screw Machine.
1—15x6 ft. A. T. & M. Co. Turret Lathe.
4—13 in. Garvin Turret Lathes.
1—16 in. Pratt & Whitney Turret Lathe.
4—No. 11 B. & S. Milling Machines.
1—10x5 ft. Prentice Engine Lathe.
1—15x8 ft. Prentice Engine Lathe.
2—16 x 5 ft. Bullard Engine Lathes.
1—18x11 ft. New Haven Engine Lathe.
1—24x12 ft. New Haven Engine Lathe.
1—26x14 ft. New Haven Engine Lathe.
1—32x14 ft. Lathe & Morse Engine Lathe.
1—32x16 ft. Phillips Engine Lathe.

ATWOOD & M'CAFFREY,

Brass Founders, Iron Pipe Fitters and Machinists,

MANUFACTURERS OF AND DEALERS IN

All Kinds of Pipe, Globe and Gate Valves, Fittings and Appliances for Steam, Gas, Water and Hydraulic Work.

Phosphor Bronze ("Elephant Brand") Castings, Coolers, Tuyeres and Cinder Notches for Blast Furnaces supplied promptly.

Rolling Mills, Steel Works, Blast Furnaces Coal and Coke Works, Power Houses for Electric Street Railways, etc., promptly fitted up by Experienced Workmen.

AIKEN Duplex and CRITCHLOW Valves, either three or four way, for operating Mill and Hydraulic Machinery of all kinds under any desired pressure, and Stop Valves for same.

Agents for the CAMERON STEAM PUMP, which is made in every possible variety, and suitable for all purposes to which Steam Pumps can be applied.

Nos. 108 to 118 Third Avenue, PITTSBURGH, PA.

gallons to be delivered against a head of 168 feet, and the steam will be supplied at a pressure of 135 lbs. to the square inch, each engine being of 600 h. p.

The Maryland Steel Co. will blow in two more furnaces next month. The steel rail mill is also expected to resume operations soon.

The New Castle Wire Nail Co., New Castle, Pa., has recently been making large records. On the Friday night turn, Feb. 5, a total of 336,000 pounds of No. 5 wire rods was rolled in 12 hours. This surpassed the last previous 12-hour record of this mill, which was 319,000 pounds. This was eclipsed on Saturday when the output reached 360,000 pounds. This is within 6,000 pounds of the best record made by any mill, and for No. 5 rods is the best reported.

The Cumberland Steel & Tin Plate Co., of Cumberland, Md., is said to be adding a new 24-in. tinning mill to its plant.

The Mannesmann Tube Works, at North Adams, Mass., will begin active operations on Feb. 22. About 600 men will be employed.

The E. P. Allis Co. is completing two large compound vertical-beam blowing engines with cylinders, high pressure steam 40 inches in diameter, low pressure steam 78 inches in diameter, two air cylinders each 76 inches in diameter. All by 60 inch stroke. The total shipping weight of each engine is over 600,000 pounds. They are considered the most substantial blowing engines ever built. The two are for export, and will be shipped to the Krainische Industrie Gesellschaft, of Triest, Austria, the largest iron manufacturing establishment in Austria. The E. P. Allis Co. has furnished 12 engines, duplicates of these, to the Carnegie Steel Co., for their furnaces at Duquesne, Pa. The Allis Co. is also negotiating for a large 1,200-barrel flour mill to be constructed in Braila, Roumania. It has received advices of the completion of a complete concentrating (gold and silver) plant, which was furnished for Jorge Basadre, Tacna, Chili, South America. This mill is situated 150 miles distant from a railroad and all the machinery had to be transported by mule, and no piece weighed over 150 pounds. Considerable heavy machinery has also been completed by the Allis Company for export to the South African gold field—hoisting engines, air compressors, etc.

At the works of the Pennsylvania Steel Co., at Steelton, Pa., notice was posted last Saturday of a ten per cent reduction in wages to take effect March 1. The reduced price for product is given as the reason for the cut. President Felton is quoted in a dispatch as saying that the company was compelled to take this step, owing to the fall in the price of steel rails. He expressed the hope that conditions would soon warrant a restoration. The wages that will rule after March 1 are practically on the basis existing in 1894 and early 1895.

The Connellsville Machine & Car Co., of Connellsville, Pa., has recently filled a number of orders for coke manufacturers and other industrial concerns throughout the State. Among them was the shipment of a 12,000 lb. iron car for the Semet-Solvay ovens operated by the Dunbar (Pa.) Furnace Co. This car is 20 feet long, open at the top and has four side gateways. It is made to run along the yard slopes in front of the by-product ovens. The red hot coke is pushed out into the car by machinery through the side gates and afterwards watered in the car, which operation takes but a very short time.

The Pittsburg feed water heater, which for the last year has been manufactured by the Ohio Machine Co., of Middleport, O., is now controlled and manufactured by the patentee and owner, J. E. Schlieper, Conestoga Bldg., Pittsburg, under the firm name of the Pittsburg Feed Water Heater & Engineering Co. The following recent sales are reported: 500 h. p. open heater to H. J. Heinz Co., Pittsburg; 600 h. p. closed heater to the Eberhard & Ober Brewing Co., Pittsburg; 1,000 h. p. open heater, Connellsville Sheet Iron & Tin Plate Co., of Connellsville, Pa.

The Harrison Safety Boiler Works, Philadelphia, report recent sales and shipments of Cochrane heaters, which they manufacture, as follows: Oliver Wire Co., Pittsburg, two 2,000 h. p.; Dunmore Electric Light, Heat & Power Co., Dunmore, Pa., 350 h. p.; Baltimore Packing Co., Minneapo-

lis, Minn., 350 h. p.; Englewood & Suburban R. R., Chicago, 750 h. p., pre. 350 h. p., and pre. 750 h. p.; Plymouth Refrigerating Co., Plymouth, Wis., 350 h. p.; Ohio Steel Co., Youngstown, O., 2,000 h. p.

The Harrison Safety Boiler Works, Philadelphia, manufacturers of the Cochrane separators, report the following recent sales and shipments: Liondale Bleach, Dye & Print Works, Rockaway, N. J., 14 in.; Charles Erith & Co., London, Eng., 6 in., 6 in.; Keystone Ice Mfg. Co., Philadelphia, Pa., 8 in., 10 in.; Coliseum Bldg., Chicago, 6 in., 3½ in., 4 in.; Alexander & Co., Pittsburg, 3 in.; Carnegie Steel Co., Ltd. (Duquesne furnaces), 18 in., 12 in., 12 in., 12 in., 12 in., 12 in., 12 in., 4½ in., 4½ in.; Red Cypress Lumber Co., Patterson, La., 3 in.; De La Vergne Refrigerating Mach. Co., New York, N. Y., 3 in., 3 in.; Cincinnati Milling Machine Co., Cincinnati, O., 4 in.; Berlin Mills Co., Berlin, N. H., 6 in.; Southern Pipe Line Co., Milway, Pa., 12 in., 12 in., 12 in.; Mont Alto, Pa., 12 in., 12 in., 12 in.; Frank J. Knox, Hartford, Conn., 4 inch; American Trading Co., Yokohama, Japan, 3½ in.; Otis Falls Pulp Co., Chisholm's Mills, Me., 7 in.; Page Belting Co., Concord, N. H., 4 in.; Manhattan Oil Co., Welker, O., 3 in.; Murtha & Early, Philadelphia, Pa., 6 in.; James & Abbott (the Philadelphia Pressed Brick Co.), Charlestown, Mass., 6 inch.

The contract for 350 tons of water pipe and special castings for the city of Dayton, O., has been awarded to the Ohio Pipe Co., of Columbus, O. The bids were the lowest ever received, the one of the Ohio Pipe Co. being $17.83 per ton for pipe, and two cents per pound for specials.

The Kimberly Mills, at Greenville, Pa., have resumed after a long shut down.

The puddlers of the Cohoes, N. Y., rolling mills have accepted a reduction in wages of about 20 cents per ton, in accordance with an agreement made by the men about a year and a half ago, to the effect that their wages should be governed by the price of iron. The employes of the other departments are not affected.

The No. 2 furnace of the Crozer Iron Co., Roanoke, Va., has been blown out for relining.

The Farnsworth & Wilson Machine Co., of Amsterdam, N. Y., has sold its entire plant to the new Budd Bros. Mfg. Co., of Glens Falls, N. Y. The latter will carry on the business.

The Alabama Bridge & Boiler Co., of Birmingham, Ala., has finished erecting the necessary buildings and has started work. Among contracts already secured by the company is the rebuilding of furnace No. 2 of the Sloss Steel & Iron Co., and also cars and ore buggies for the Clifton Iron Co., Ironaton, Ala.

Star Furnace, at Jackson, O., will probably be out of blast for two or three months as the result of the recent fire.

The Paterson Iron Co. has been placed in the hands of S. S. Sherwood, receiver. It is said that the company's liabilities are between $65,000 and $80,000, and the assets from $150,00 to $160,000. It is expected to reorganize the company, and increase its working capital.

The South Pittsburg Pipe Works, South Pittsburg, Tenn., is about to resume operations.

EXCURSIONS TO MEXICO

Via Pennsylvania Lines, January 19th and February 27th.

Under escort of American Tourist Association, Reau Campbell, General Manager. Sleeping and dining cars and special baggage cars through all the tour without change. More miles and days in Mexico, more cities and towns than ever offered. Tickets include all expenses, sleeping and dining cars, hotels, etc. For information, apply to F. Van Dusen, Chief Assistant General Passenger Agent, Pennsylvania Lines, Pittsburg, Pa.

To Washington, D. C.,

For the Inauguration, go via the C. T. & V. R. R., in connection with the picturesque B. & O. daylight trip over the mountains, or through sleepers on night trains. Only $11 round trip. Tickets good going March 1st, 2d and 3d. Limited to the 8th for return. See your C. T. & V. agent for particulars.

Steam Yachts and Marine Machinery.

Also Towing Launches' built by Marine Iron Works, Clybourn and Southport avenues, Chicago. Free illustrated catalogue. Write them for it.—*Adv.*

INTERESTS YOU

THE ROBERTSON THOMPSON INDICATOR enables you at all times to determine if your ENGINE is developing full power for amount of COAL consumed.

DON'T YOU NEED A

FEED WATER HEATER,	STEAM SEPARATOR,
DAMPER REGULATOR,	OIL EXTRACTOR,
EXHAUST HEAD,	OIL FILTER,
EUREKA PACKING,	SQ. FLAX PACKING.

Indicator	$40
Reducing Wheel	$15
Planimeter	$15

Easy terms to ENGINEERS with responsible backing.

We are manufacturers and can make prices meet your views.

JAS. L. ROBERTSON & SONS, 88 Cortlandt St. NEW YORK.
Successors to Hine & Robertson Co.

Hoisting, Crushing and Mining Machinery.

EARLE C. BACON,
ENGINEER,
Havemeyer Building, New York.
WORKS.
Farrel Foundry & Machine Co. and Pacific Iron Works.

BACON'S
HOISTING ENGINES
For Every Possible Duty.
MINE CARS, SKIPS and MINE EQUIPMENT.

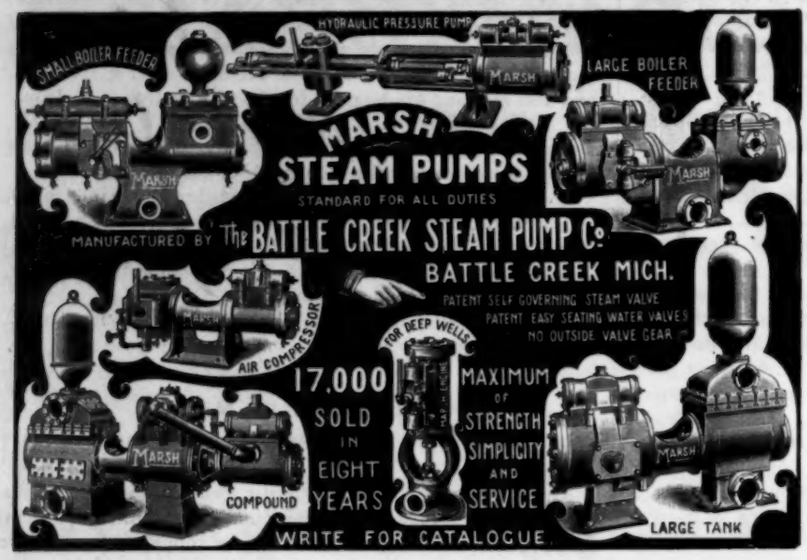
"FARREL'S" (Blake Pattern)
ORE AND ROCK CRUSHERS
AND
HIGH SPEED OR GEARED CRUSHING ROLLS

COMPLETE HOISTING, CRUSHING AND MINING PLANTS OUR SPECIALTY FOR OVER 20 YEARS, AND IN USE IN ALL PARTS OF THE WORLD.
Send for our Completely Illustrated Catalogues.

..'96 JENKINS '96..

Is the Perfection of Joint Packing. Instantaneous. Does not Squeeze Out and not Necessary to follow up Joint. We guarantee it to last for years on any and all pressures of steam or any kind of joint where packing is required. Does not Rot, Burn or Blow Out, therefore the best for all purposes. Call for and insist on having '96 JENKINS '96 stamped like cut.
Jenkins Bros., New York, Boston, Philadelphia Chicago.

THE FINISHED STEEL CO
YOUNGSTOWN, OHIO
MFR'S OF POLISHED SHAFTING



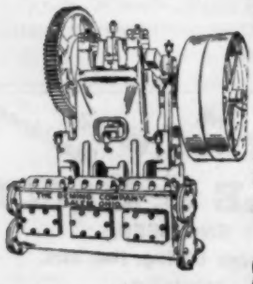
WORTHINGTON STEAM PUMPS

HENRY R. WORTHINGTON,

NEW YORK.

Boston. Philadelphia. Chicago. Cleveland. St. Louis. Indianapolis. Detroit. Atlanta. Pittsburg

SEND FOR CATALOGUE.



TRIPLEX PUMPS

Four Types and Eight Sizes for ELECTRIC AND OTHER POWER. SINGLE AND DOUBLE-ACTING CYLINDERS.

Unequaled in Design and Construction.

Adapted for Water Works, Hydraulic Elevators, Boiler Feeding, Apartment Houses, Mine Pumping, Irrigation, Paper Mills, Refineries, Breweries, Etc.

MADE BY

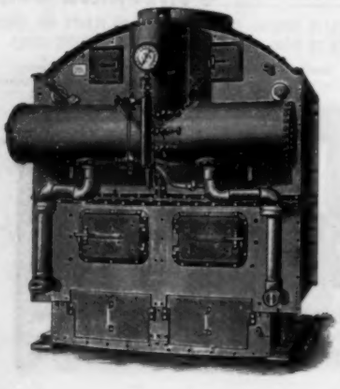
THE DEMING CO., SALEM, O.

General Agencies: HENION & HUBBELL, 61-69 N. Jefferson St., Chicago. HARRIS PUMP & SUPPLY CO., 320-322 2nd Ave., Pittsburg. W. P. DALLETT, 49 N. 7th St., Philadelphia. C. J. JAGER CO., 174 High St, Boston.

General Service Triplex Pumps.

The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year **$3.00.**



. . . ALMY'S . . .

PATENT SECTIONAL WATER TUBE BOILERS

FOR

Steamships, River Steamers, both propellers and stern wheels, Torpedo Boats, Fire Boats, Yachts and Launches, Donkey Boilers for Steamships, and for all kinds of Stationary Work.

This Boiler possesses more advantages than any other Boiler.

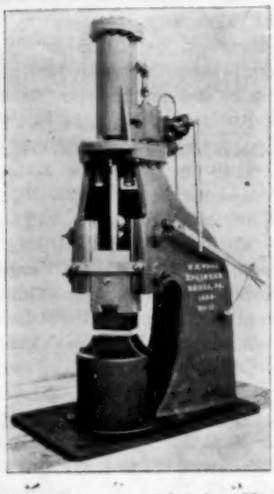
It has STOOD THE TEST of over seven years' constant daily use in passenger steamers, and is in use in many of the best steam yachts. It has proved its durability to be equalled by none. It has shown from 10 to 15 per cent saving in every day work over the best Marine Fire-Tube Boiler.

It is one-third the weight of the Scotch Boiler for the same power and efficiency. It is non-explosive. No priming, and easy to manage.

ALMY WATER TUBE BOILER CO.,

178-184 Allen's Ave., near Rhodes St., PROVIDENCE, R. I.

STEAM HAMMERS



PATENTED HYDRAULIC MACHINERY. Riveting Machines, Flanging Presses, Punching, Shearing and Forming Machines.

Accumulators, Cranes, Pumps, Etc.

WM. H. WOOD, ENGINEER, MEDIA, PA

Builder of Special Machinery.

The Iron Trade Review has a rapidly growing constituency in the great Central Zone, the best buying section in the country, as machinery manufacturers and establishments devoted to power equipment have found out in the past three years. Between the Alleghenies and the Mississippi are located many of the most prosperous industries in the country, and they have been buyers when there was only limited business in other sections. Advertisers are coming to recognize this fact, as the growing patronage of the columns of this paper gives abundant testimony.

SHIFFLER BRIDGE COMPANY,

BUILDING DEPARTMENT.

SPECIALTIES: Steel and Iron Buildings for Rolling Mills, Tin Plate Plants, Steel Works, Foundries, Factories, Roof Trusses, Girders, Columns, Beams, Corrugated Iron, Etc.

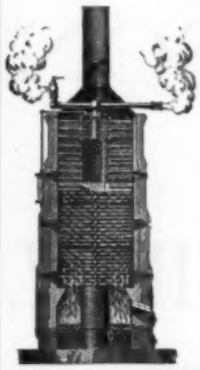
Main Office and Works:

48th Street and A. V. Ry., PITTSBURG, PA

Branch Offices:

1123 Betz Building, Philadelphia, Pa.
45 Broadway, New York, N. Y.
228 Lumber Exchange, Minneapolis, Minn.
1243 Marquette Building, Chicago, Ill.

The Great Coal Saver and Producer of Dry Steam.



THE HAZELTON OR PORCUPINE BOILER.

THE PIONEER VERTICAL WATER-TUBE BOILER
. . OF THE WORLD. . .

16 Years' Unequalled Record for Economy, Safety and Durability.

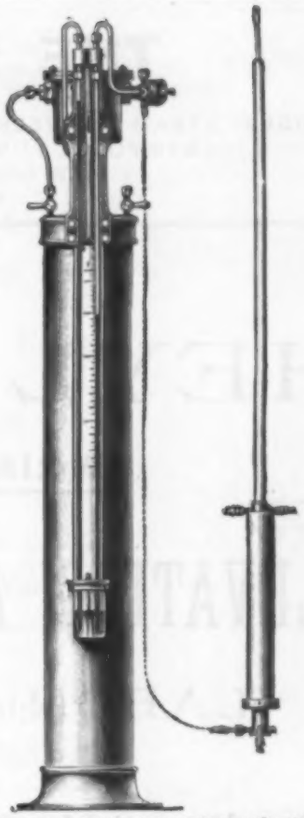
No Explosions or Accidents of Any Kind.

CORRESPONDENCE SOLICITED.

THE HAZELTON BOILER CO.,

SOLE PROPRIETORS AND MANUFACTURERS,

Telephone 1229, 18th St. N. Y. GENERAL OFFICE:
Cable Address, "Falls," N. Y 716 East 13th St., NEW YORK, U. S. A.



THE PNEUMATIC PYROMETER.

Stationary and Portable.

SENSITIVE, ACCURATE AND DURABLE TO

3,000 DEGREES.

Uehling, Steinbart & Co., Ltd.,
64 Mulberry Street,
NEWARK, N. J.

The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year $3.00.

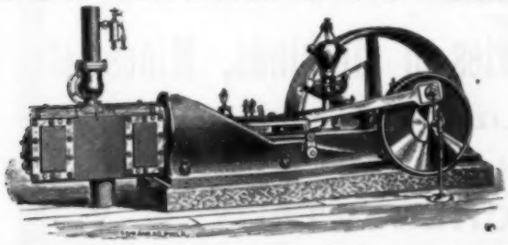
A growing circulation among machine shop and foundry firms, has
THE IRON TRADE REVIEW.

SOUTHWARK FOUNDRY & MACHINE CO.

PHILADELPHIA, PA.,

SOLE MAKERS OF THE

PORTER-ALLEN AUTOMATIC ENGINE.



FEATURES OF THIS ENGINE
Simplicity of Design,
Highest Economy of Steam,
Close Regulation of Speed,
Minimum Floor Space.

ALSO BUILDERS OF
Blowing and Reversing Engines,
Water Works Pumping Engines,
Centrifugal Pumps and Weiss
Counter-Current Condensers.

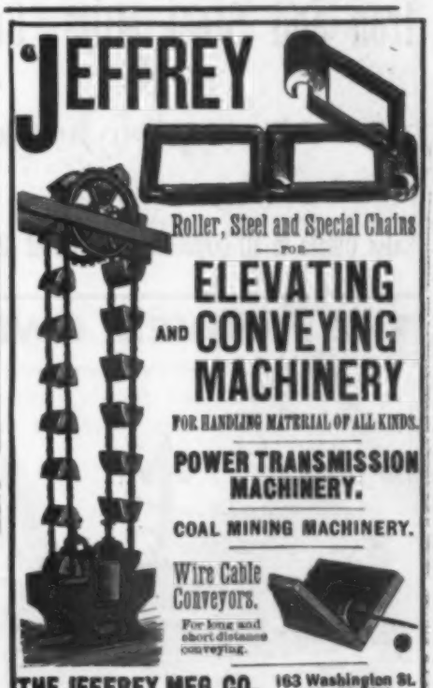
WESTINGHOUSE, CHURCH, KERR & CO.

ENGINEERS.

STEAM ENGINES. STEAM LOOPS.
COMPLETE STEAM PLANTS. COMPLETE ELECTRICAL PLANTS.
REFRIGERATING MACHINERY.
COMPLETE ICE PLANTS.
MECHANICAL STOKERS. MECHANICAL DRAFT.
COMPLETE BOILER PLANTS. COMPLETE ECONOMIZER PLANTS.

NEW YORK 26 Cortlandt Street. BOSTON. 53 State Street. PITTSBURG. Westinghouse Bldg. CHICAGO. 171 La Salle Street.

"JEFFREY"



Roller, Steel and Special Chains
—FOR—
ELEVATING AND CONVEYING MACHINERY
FOR HANDLING MATERIAL OF ALL KINDS.

POWER TRANSMISSION MACHINERY.

COAL MINING MACHINERY.

Wire Cable Conveyors.
For long and short distance conveying.

THE JEFFREY MFG. CO. Columbus, Ohio. 163 Washington St. NEW YORK.
Send for Catalogue.

THE BUCYRUS COMPANY,

DESIGNERS AND BUILDERS OF

DREDGES, STEAM SHOVELS, EXCAVATING MACHINERY,
CENTRIFUGAL PUMPS, WITH SIMPLE, COMPOUND OR TRIPLE EXPANSION ENGINES,
PILE DRIVERS, WRECKING CARS, LOCOMOTIVE CRANES,
PLACER MINING MACHINERY. SOUTH MILWAUKEE, WISCONSIN.

.....ESTABLISHED 1887.....

HEYL & PATTERSON

ENGINEERS AND CONTRACTORS.

ELEVATING AND CONVEYING MACHINERY,

LABOR SAVING APPLIANCES.

COMPLETE INSTALLATIONS.

Office No. 108 Market St.. -:- PITTSBURG, PA

LONG DISTANCE TELEPHONE 746.

GENERAL ELECTRIC COMPANY

Electrical Apparatus

FOR THE ECONOMICAL OPERATION OF

Iron and Steel Mills, Engine Shops, Factories of all kinds, Mines, etc.

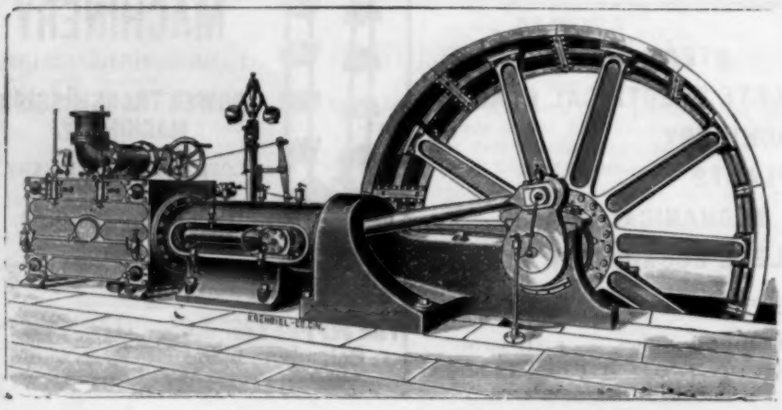
WATER-POWERS UTILIZED.

ESTIMATES AND PRICES ON APPLICATION.

Main Office, SCHENECTADY, N. Y.

Sales Offices in all large Cities in United States. Foreign Department, 44 Broad Street, New York.

THE HOOVEN, OWENS & RENTSCHLER CO., Hamilton, O.



Hamilton Corliss Engines.

Engines for Rolling Mills, Electric Railways and Electric Light.

Engines of all Sizes and for all purposes.

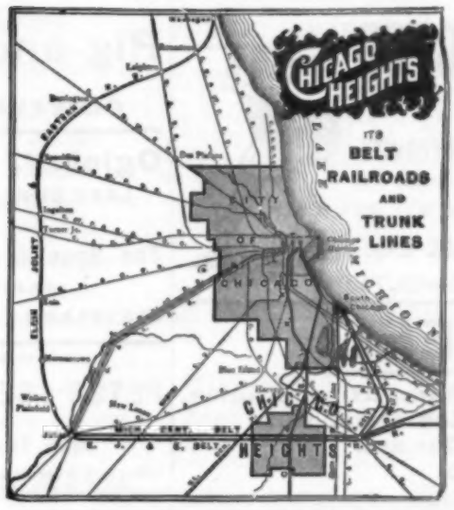
46 South Canal St., CHICAGO.
39 and 41 Cortlandt St., NEW YORK.
Lewis Block, PITTSBURGH, PA.
Room A, Laclede Building, ST. LOUIS, MO.
C. C. MOORE & CO., SAN FRANCISCO, CAL.

Manufacturers

Don't continue in the old rut and rust out.
Be progressive—keep in touch with the times.

Move to Chicago Heights

where you can reduce the cost of production and cheaply distribute the product of the factory to the consumer.



Free Factory Sites.

Cheap Fuel.

Chicago Freight Rates.

Free Water.

Free Switching Facilities.

Write to us to-day for full information.

CHICAGO HEIGHTS LAND ASSOCIATION,

THE LARGEST REAL ESTATE FIRM IN AMERICA.

Capital Paid in $1,250,000.00.

General Offices, 172 Washington Street,

Corner Fifth Avenue. CHICAGO.

The Kellogg Weldless Tube Co.,

MANUFACTURERS OF

Seamless Steel Tubes,

For Hydraulic Tubes, Jacks, Presses and Hoists, Lathe Spindles, Bicycle Hub Stock Projectiles, Hollow Shafting, Shells for Carbonic Acid and other Gases, Piston and Valve Rods, Axles, Bolts and Columns, Working Barrels, Roller Bearings, Bushings, Couplings, Boiler Tubes and other purposes where

Strength, Uniformity and Durability

ARE REQUIRED.

Findlay, O.

Our tubes are hot drawn, without weld or seam; from the best quality of steel, in lengths from 8 to 25 feet, and of any degree of hardness, from .08 to .60 carbon —They are equal in every respect, except finish, to cold drawn tubes and are offered at a much lower price.

For special work, requiring extremely low sulphur and phosphorus, we are prepared to guarantee a maximum of

.020 SULPHUR and .015 PHOSPHORUS.

The following Sales Agencies will be pleased to supply any additional information that may be desired, viz:

Kellogg Weldless Tube Co.,
45 Milk Street, Boston.
Wm. J. Haines & Co.,
906 Filbert Street, Philadelphia.
Henry L. Coe,
727 Garfield Bldg., Cleveland.
Kellogg Weldless Tube Co.,
New York City.
M. T. Miles & Son,
317 and 318 Western Union Bldg., Chicago.
C. R. Talbot & Co.,
9 and 10 Wiggins Blk., Cincinnati.

Soft Steel Bars, Light

LOW PRICES

do not always influence business. Some brands of goods are undesirable as a **Gift.**

Write us for our catalogue and send us a sample order and see if there is not **Economy** in using **First Quality** goods at Fair Prices.

Structural Shapes, Rails.

TIN PLATES,
CALVANIZED SHEETS,
CORRUGATED IRON,
BLACK PLATES,

Sheet Iron and Steel, any finish, patent leveled or common.

Aetna Standard Iron & Steel Co.,
BRIDGEPORT, OHIO.

'97 IS YET NEW, SO BEGIN THE YEAR RIGHT

—BY USING—

CLINTON AND HECTOR

Inspected Foundry Irons

—FOR—

SOFTNESS, STRENGTH, FLUIDITY, UNIFORMITY.

Quality has given it a high position in the trade, it is no experiment, try it.

MANUFACTURED BY

CLINTON IRON & STEEL CO.,

ew York Office: No. 15 Cortlandt St. Furnaces: Pittsburgh, Pa.

CAMBRIA STEEL.

Steel Rails, Blooms, Billets, Beams, Bars, Axles, Angles, Channels, Castings, Forgings, Zee Bars, Car-Channels, Locomotive, Car and Structural Steels, etc.

CAMBRIA IRON COMPANY, S. W. Cor. 15th and Market Sts., opp. Penna. R. R. Station, Philadelphia; Chicago office, Western Union Building; New York office, (for Rails and Axles), 33 Wall St.; Cleveland office, Bourne, Fuller & Co; Detroit office, Newberry Bldg.; Toledo office, The Nasby, No. 401; Cincinnati office, cor. Elm and Pearl Sts. Works at Johnstown, Pa.

GAUTIER STEEL DEPARTMENT OF CAMBRIA IRON CO.,

JOHNSTOWN, PA.

MERCHANT BAR STEEL: Including Tire, Toe Calk, Machinery, Carriage Spring, Railroad Spring, Hoe, Rake, Fork, etc.

AGRICULTURAL STEEL AND SHAPES: Finger Bars, Knife Backs, Rake Teeth, Bundle Carrier Teeth, Tedder Forks and Springs, Spring Harrow Teeth, Harrow (Drag) Teeth, Seat Springs, etc.

PLOW STEEL: Flat and Finished Plow Shapes, Digger Blades, Slabs (Penn and Pernot), Hammered Lay, Rolled Lay, etc.

Cold Rolled Steel Shafting. **Steel Harrow Discs.** **Cambria Link Barb Wire.**

New York Office, 102 Chambers St.	Philadelphia Office, 611 Phila. Bourse.	Chicago Office, 209 Western Union Bldg.	Atlanta Office, 325 Decatur st.

CLEVELAND ROLLING MILL CO.,

CLEVELAND, - OHIO,

—MANUFACTURERS OF—

BESSEMER AND OPEN-HEARTH STEEL,

Blooms, Billets, and Slabs, Steel Rails, Steel Beams, Channels and Angles. Steel Forgings, Ba Spring, and Sleigh Shoe Steel. Steel Wire of all kinds. Barbed Wire, Iron and Steel Plates, Galvanized and Black Sheet Iron and Steel Corrugated Iron Roofing.

W. H. COFFMAN COKE CO.

BLUEFIELD, W. VA.

GENERAL FACTORS AND SHIPPERS OF

POCAHONTAS FLAT-TOP COKE.

So low in ash that it requires no fluxing for foundry purposes. Our foundry and furnace coke was awarded the first premium at the World's Fair in 1893.

AVERAGE ANALYSIS OF COKE.

Moisture	00.196	Sulphur	00 677
Fixed Carbon	93.625	Ash	05.004
Volatile Matter	00 494		

Foundry Furnace and all sizes of crushed coke. Guaranteed lower in Sulphur than any other commercial coke

LAKE SUPERIOR CONSOLIDATED IRON MINES

HIGH GRADE MISSABE BESSEMER ORES.

From the **ADAMS MINE,** for sale by **TOD, STAMBAUGH & CO., Agts., Cleveland, O.**
From the **BURT, HULL and RUST MINES,** for sale by **OGLEBAY, NORTON & CO., Agts., Cleveland, O.**

THE BOURNE-FULLER CO.,

Pig and Bar Iron,

CLEVELAND, . OHIO.

Oglebay, Norton & Co.,

LAKE SUPERIOR IRON ORES.

— AGENTS —

The Spanish-American Iron Co.,
Santiago, Cuba.

CLEVELAND. PHILADELPHIA.

ESTABLISHED 1854.

PETER GERLACH & CO.,

MAKERS OF

Saws, Tools and Machinery.

Office and Warerooms, 28 Columbus St.
Factories on Columbus, Winter and Leonard Sts.

Cleveland, Ohio, U. S. A.

CLEVELAND ELECTROTYPE CO.

ELECTROTYPING ENGRAVING AND STEREOTYPING.

50 HIGH ST. — TEL. 2139.

M. A. HANNA & CO.

IRON ORE,

PIG IRON AND COAL.

CLEVELAND, OHIO.

F. A. BATES, M. M. DRAKE, J. H. BARTOW.
Buffalo.

DRAKE, BATES & CO.

IRON ORES.

Mines:

CINCINNATI, ROBERTS, } Bessemer.

HALE,—Non-Bessemer.

Wade Building, CLEVELAND, O.

J. WESLEY PULLMAN

No. 238 South Third St., PHILADELPHIA.

Lake Superior Ores. Warwick Pig Iron.

NEW JERSEY AND NEW YORK

MAGNETIC ORES

JESSOP'S STEEL —FOR— **Tools, Drills, Dies, etc.**

Established over a Century ago. Manufactory, SHEFFIELD, ENGLAND.

CHIEF AMERICAN OFFICE, 91 JOHN ST., NEW YORK.

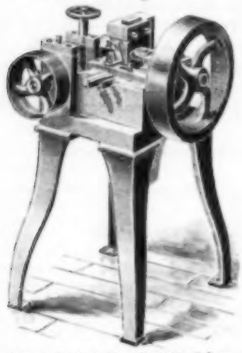
WM. JESSOP & SONS, Limited.

"Medal—World's Columbian Exposition, 1893."

All sizes carried in stock by The W. Bingham Co., Cleveland, Ohio.

This Staple Machine

Makes 300,000 Staples Per Day Directly from the Coil



Shear Point Staple Machine.

and is furnished with tools adjustable in width, also to any length from ¼ to 2½ inches inclusive. Prices $250.00 up. Send for catalogue, price lists, etc., with sample.

JOHN ADT & SON,

F. B. Shuster, Prop.

NEW HAVEN, CONN.

BUILDERS OF

Roll and Rotary Wire-Straighteners, Automatic Wire-Straightening and Cutting Machinery, Riveting Machines, Special Automatic Machinery, Etc.

SUBSCRIBE FOR

THE IRON TRADE REVIEW.

ARE YOU LOOKING

FOR A CHANGE IN LOCATION?

If you are not satisfied with your present site, or if you are not doing quite as well as you would like to, why not consider the advantages of a location on the Illinois Central R. R. or the Yazoo & Mississippi Valley R. R.? These roads run through South Dakota, Minnesota, Iowa, Wisconsin, Illinois, Indiana, Kentucky, Tennessee Mississippi and Louisiana, and possess

FINE SITES FOR NEW MILLS,

BEST OF FREIGHT FACILITIES,

CLOSE PROXIMITY TO

COAL FIELDS AND DISTRIBUTING CENTERS

AND

INTELLIGENT HELP OF ALL KINDS,

MANY KINDS OF RAW MATERIAL.

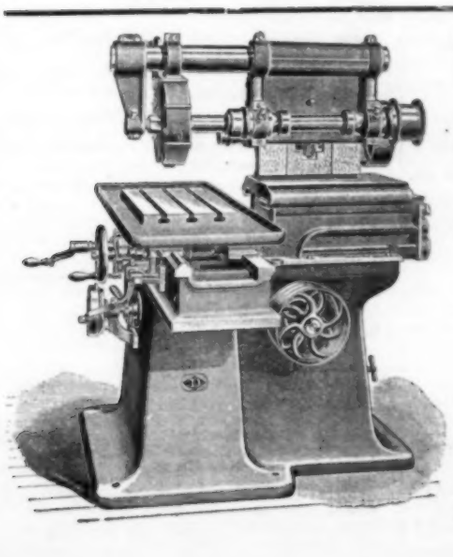
For full information, write the undersigned for a copy of the pamphlet entitled

100 Cities and Towns **WANTING INDUSTRIES**

This will give you the population, city and county debt, death rate, assessed valuation of property, tax rate, annual shipments, raw materials, industries desired, etc.

To sound industries, which will bear investigation, substantial inducements will be given by many of the places on the lines of the Illinois Central R. R., which is the only road under one management running through from the North. Western States to the Gulf of Mexico. GEO. C. POWER, Industrial Commissioner I. C. R. R. Co., 506 Central Station, Chicago. I-2-'94

The Iron Trade Review is an increasingly valuable medium through which to sell equipment to machine shop and foundries.



Diamond Surface Grinding Machine.

Capacity 12x24 up to 12x60

A better machine never was made.

SEND FOR CIRCULAR.

DIAMOND MACHINE CO.,

PROVIDENCE, R. I. and CHICAGO, ILL.

IF YOU HAVE

A WEIGHT TO LIFT,

Get a Good Hoist.
Get the Best Hoist.
Get the Harrington Hoist.

Made Only in Philadelphia.

EDWIN HARRINGTON SON & CO., Inc.,

1526 Penna. Ave., PHILA., PA.

MANUFACTURERS

Improved Machine Tools.

SECOND-HAND NUT AND BOLT MACHINERY.

FOR SALE AT A BARGAIN.

2 Nat. Improved Lewis Bolt Headers, list each $800. Our price each $450.
1 Nat. Hot Pressed Nut Machine (Class A), list $1200. Our price $800.
3 Nat. Double Rapid Bolt Cutters, to 1 inch, list each $425. Our price each $200.
1 Nat. Double Rapid Bolt Cutter, to ¾ inch, list $310. Our price $160.
1 Nat. Single Rapid Bolt Cutter, list $175. Our price $75.
1 Nat. Large Pedestal Bolt Pointer, list $150. Our price $50.

Above machines are all of improved make of the National Machinery Co., Tiffin, O., and are in good working order. We offer them at above prices, which are about one-half their value.

Address T. L. PAINE, Manager,
P. O. Box 508, Milwaukee, Wis.

FOR SALE.

Two Morgan Traveling Cranes, each ten tons' capacity, span 45 ft. 6 in. In first-class condition.

THE WESTINGHOUSE MACHINE COMPANY

PITTSBURGH, PA.

Cleveland Union Station.

Pennsylvania Lines.

Foot of Bank Street.

TICKET OFFICES at Station, Euclid Av., Woodland Av., and Weddell House corner.

THROUGH TRAINS RUN AS FOLLOWS BY CENTRAL TIME
* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7:00 am	†12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	† 3:15 pm	† 6:25 pm
Philadelphia and New York	* 1:40 pm	*11:25 am
Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
Ravenna and Alliance	* 5:00 pm	* 8:30 am
Philadelphia and New York	*11:10 pm	* 4:30 am
Baltimore and Washington	*11:10 pm	* 4:30 am
Alliance and Pittsburgh	*11:10 pm	* 4:30 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8:10 am	* 5:45 pm
Akron and Columbus	* 8:10 am	* 5:45 pm
Akron and Columbus	† 1:40 pm	†12:10 pm
Columbus and Cincinnati	* 8:00 pm	* 7:30 am

The Cleveland Terminal & Valley R. R. Co

(B. & O. System.)

Depot foot of So. Water St. City Office 241 Superior St.	Arrive.	Depart.
Valley Jctn. & Way Stations	*6:30 P M	*7:10 A M
Akron, Canton & Valley Jct	*10:10 A M	*3:15 P M
Akron, Canton & Chicago	*8:10 A M	*6:30 P M
Akron, Canton & Wooster, Defiance, Garrett, Marietta, Wheeling, Washington, D. C., and Baltimore	†2:55 P M	†11:00 A M

†Daily except Sunday. *Daily. Pullman's Palace Vestibule sleeping cars between Cleveland and Chicago.

If you are thinking of enlarging your mill, foundry or machine shop, or of purchasing machinery of any kind, send us a line giving character of machinery needed. We can put you in communication with manufacturers from whom you can buy advantageously.

BUYERS' DIRECTORY OF IRON AND STEEL TRADES.

Air Compressors—
Rand Drill Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
The Norwalk Iron Works Co., So. Norwalk, Ct.
Clayton Air Compressor Works, New York.

Analytical Chemists—
Dickman & MacKenzie, Chicago, Ill.
F. A. Emmerton, Cleveland, O.
O. Textor, Cleveland, O
Robert W. Hunt & Co., Chicago, Ill.
Wellman Seaver Engineering Co., Cleveland, O.

Anti-Friction Metal—
C. H. Besly & Co., Chicago, Ill.
North American Metaline Co., Long Island City, N. Y.
Magnolia Metal Co., New York City, N. Y.

Babbitt Metal—
C. H. Besly & Co., Chicago, Ill.

Belting—
C. H. Besly & Co., Chicago, Ill.

Blacksmith and Carriage Supplies—
C. H. Besly & Co., Chicago, Ill.

Blowers—
Buffalo Forge Co., Buffalo, N. Y.
B. F. Sturtevant Co., Boston, Mass.

Blast Furnace Supplies—
Atwood & M'Caffrey, Pittsburg, Pa.
Enterprise Boiler Co., Youngstown, O.

Boilers and Boiler Attachments—
Wm. B. Pollock & Co., Youngstown, O.
S. Freeman & Sons Mfg. Co., Racine, Wis.
Cahall Sales Department, Pittsburg, Pa.
Enterprise Boiler Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co.
Fulton Steam Boiler Wks. & Fdy., Richmond Ind.
The Hazelton Boiler Co., New York.
Clonbrock Steam Boiler Co., Brooklyn, N. Y.
Harrison Safety Boiler Works, Philadelphia.
Lane & Bodley Co., Cincinnati, O.
Almy Water Tube Boiler Co., Providence, R. I.
Westinghouse, Church, Kerr & Co., Pittsburg, Pa.

Boiler Covering—
C. H. Besly & Co., Chicago, Ill.

Boiler Fronts and Fittings—
The Lane & Bodley Co., Cincinnati, O.

Boiler Tubes—
S. Fix Sons, Cleveland.

Bolts and Bolt Machinery—
Upson Nut Co., Cleveland.

Bolts and Nuts—
Upson Nut Co., Cleveland, O.

Boring and Turning Mills—
H. Bickford, Lakeport, N. H.

Brass Castings—
Nolte Brass Co., Springfield, O.

Brass Work (Special Finished)—
Nolte Brass Co., Springfield, O.

Bridges—
Shiffler Bridge Co., Pittsburg.

Buildings (Steel Frame.)—
Shiffler Bridge Co., Pittsburg.

Carbon Points—
Jeffrey Mfg. Co., Columbus, O.

Castings—
Lorain Foundry Co., Lorain, O.

Castings (Brass)—
Nolte Brass Co., Springfield, O.
Lorain Foundry Co., Lorain, O.

Chain Hoists—
Moore Mfg. Co., Milwaukee, Wis.

Chemists—
Dickman & MacKenzie, Chicago, Ill.
F. A. Emmerton, Cleveland, O.
O. Textor, Cleveland, O.
Robert W. Hunt & Co., Chicago, Ill.

Chilled and Sand Rolls—
The Lloyd-Booth Co., Youngstown, O.
Wm. Tod & Co., Youngstown, O.
Lorain Foundry Co., Lorain, O.

Coal and Coke—
Forster, Waterbury & Co., Chicago, Ill.
C. K. Pittman, Chicago, Ill.
Pickands, Brown & Co., Chicago, Ill.
W. H. Coffman Coke Co., Bluefield, W. Va.

Core Compound—
National Jeloluse Co., New York City.

Corrugated Iron—
Sykes Iron & Steel Roofing Co., Niles, O.
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.

Conveyors—
Jeffrey Mfg. Co., Columbus, O.
Heyl & Patterson, Pittsburg, Pa.

Cranes and Derricks—
Wm. Tod & Co., Youngstown, O.
American Hoist & Derrick Co., St. Paul, Minn.
Marion Steam Shovel Co., Marion, O.
Brown Hoisting & Conveying Machine Co., Cleveland, O.
Edwin Harrington, Son & Co., Philadelphia.
Moore Mfg. Co., Milwaukee Wis.

Damper Regulators—
Jas. L. Robertson & Sons, New York.

Dies—
Toledo Machine & Tool Co., Toledo, O.

Double Spindle Lathes—
Dietz, Schumacher & Boye, Cincinnati, O.

Drills—
Dietz, Schumacher & Boye, Cincinnati, O.

Drill Presses—
Lodge & Shipley Machine Tool Co., Cincinnati.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington, Son & Co., Philadelphia.

Drop Presses—
Toledo Tool & Machine Co., Toledo, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.

Dry Kilns—
Buffalo Forge Co., Buffalo, N. Y.
B. F. Sturtevant Co., Boston.

Dynamos—
Westinghouse Electric & Mfg. Co., Pitts
General Electric Co., Schenectady, N. Y.

Eave Troughs and Conductors—
Berger Mfg. Co., Canton, O.

Electrical Supplies—
Westinghouse Electric & Mfg. Co., Pitts urg
General Electric Co., Schenectady, N. Y.
Westinghouse, Church, Kerr & Co., Pittsburg, Pa.
Card Electric Co., Mansfield, O.

Elevators—
The Lane & Bodley Co., Cincinnati, O.

Elevating and Conveying Machinery—
Heyl & Patterson, Pittsburg, Pa.

Emery and Corundum Wheels—
J. Wendell Cole, Columbus and Chicago.
Sterling Emery Wheel Mfg. Co., Tiffin, O.
Diamond Machine Co., Providence, R. I.

Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Sterling Emery Wheel Mfg. Co., Tiffin, O.
Diamond Machine Co., Providence, R. I.

Engineers and Contractors—
Robert W. Hunt & Co., Chicago, Ill.
Wellman Seaver Engineering Co., Cleveland, O.
Edward E. Erikson, Pittsburg, Pa.
Westinghouse, Church, Kerr & Co., Pittsburg Pa.
Heyl & Patterson, Pittsburg, Pa.

Engineers' Supplies—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Engravers and Electrotypers—
Cleveland Electrotype Co., Cleveland, O.

Engines (Gas)—
The Prouty Co., Chicago, Ill.

Engine Packing—
C. H. Besly & Co., Chicago, Ill.

Engines (Steam)—
Wm. Tod & Co., Youngstown, O.
B. F. Sturtevant Co., Boston, Mass.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co.
Buffalo Forge Co., Buffalo, N. Y.
Lane & Bodley Co. Cincinnati, O.
Westinghouse, Church, Kerr & Co., Pittsburg, Pa.

Exhaust Heating Apparatus—
B. F. Sturtevant Co., Boston, Mass.
Buffalo Forge Co. Buffalo, N. Y.

Exhaust Heads—
Jas. L. Robertson & Sons, New York.

Factory Sites—
Chicago Heights Land Association, Chicago.

Fans—
Buffalo Forge Co., Buffalo N. Y.
B. F. Sturtevant Co., Boston, Mass.

Feed Water Heaters and Purifiers—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Jas. L. Robertson & Sons, New York.
Harrison Safety Boiler Works, Philadelphia, Pa.

Files, Makers of—
C. H. Besly & Co., Chicago, Ill.

Fire Brick and Clay—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Reese, Hammond & Co., Bolivar, Pa.
Clearfield Fire Brick Co., Clearfield, Pa.
Stowe, Fuller & Co., Cleveland, O.
Dover Fire Brick Co., Cleveland.
F. B. Stevens, Detroit, Mich
Stuart Fire Brick Co., Pittsburg, Pa.

Fire Proof Covering—
C. H. Besly & Co., Chicago, Ill.

Flasks—
Brass Founders' Supply Co., Newark, N. J.

Foot and Power Lathes—
Lodge & Shipley Machine Tool Co., Cincinnati.

Foundries—
Wm. Tod & Co., Youngstown, O.
Lorain Foundry Co., Lorain, O.
The Rippel Mfg. Co., Mt. Gilead, O.
S. Freeman & Sons Mfg. Co., Racine, Wis.
The Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton, O
Fulton Steam Boiler Wks. & Fdy., Richmond, Ind.
W. A. Jones Foundry Co., Chicago.
East Chicago Foundry Co., Chicago.

Foundry Supplies—
Newport Sand Bank Co., Newport, Ky.
Clearfield Fire Brick Co., Clearfield, Pa.
Stuart Fire Brick Co., Pittsburg, Pa.
F. B. Stevens, Detroit, Mich.
National Jeloluse Co., New York City.
Brass Founders' Supply Co., Newark, N. J.
The Ohio Sand Co., Conneaut, O.

Forgings—
Cleveland City Forge & Iron Co., Cleveland.

Friction Metal—
Magnolia Metal Co., New York City, N. Y.

Furnaces—
Brightman Furnace Co., Cleveland, O.
Playford Stoker Co., Cleveland, O.

Furnace Linings—
Union Mining Co., Mt. Savage, Md.

Fuel Oil Burners—
W. S. Rockwell & Co., New York City.

Galvanizers—
Cleveland Galvanizing Works, Cleveland, O.

Gears—
Superior Machine Co., Cleveland, O.

Gear Cutting—
The R. D. Nuttall Co., Allegheny, Pa.
Superior Machine Co., Cleveland, O.

Grindstones—
C. H. Besly & Co., Chicago, Ill.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City N. J.,

Gray Iron Castings—
Kurtz & Buhrer, Foundry Co., Chicago, Ill.
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.

Hammers—
Beaudry & Co., Boston, Mass.
Wm. H. Wood, Media, Pa.

Hoists—
Edwin Harrington Son & Co., Philadelphia.
Moore Mfg. Co., Milwaukee, Wis.

Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

Heating and Ventilating Apparatus—
Buffalo Forge Co., Buffalo, N. Y.
B. F. Sturtevant Co., Boston.

Heavy Hardware—
C. H. Besly & Co., Chicago, Ill.

Hoisting Engines—
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.

Hoisting Machinery—
Link-Belt Machinery Co., Chicago, Ill.

Hydraulic Machinery—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Wm. H Wood, Media, Pa.

Ingot Molds—
Lorain Foundry Co., Lorain, O.

Injectors—
C. H. Besly & Co., Chicago, Ill.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct

Iron Buildings—
Shiffler Bridge Co., Pittsburg, Pa.

Iron Nails and Steel—
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
Cambria Iron Co., Johnstown, Pa.

Iron and Steel Roofing—
Sykes Iron & Steel Roofing Co., Niles, O.
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.

Iron Ore, Bar and Pig Iron—
Lake Superior Consolidated Iron Mines, New York City, N. Y.
Oglebay, Norton & Co., Cleveland.
Condit-Fuller Co., Cleveland.
Forster, Waterbury & Co., Chicago, Ill.
Junction Iron & Steel Co., Mingo Junction, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Cincinnati Corrugating Co., Piqua, O.
Cambria Iron Co., Johnstown, Pa.
Clinton Iron & Steel Co., Pittsburg.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
Drake, Bates & Co., Cleveland, O.

Iron Working Tools—
Toledo Machine & Tool Co., Toledo, O.
H. Bickford, Lakeport, N. H
Lodge & Shipley Machine Tool Co., Cincinnati.
C. H. Besly & Co., Chicago, Ill.
John Adt & Son, New Haven, Conn.
Diamond Machine Co., Providence, R. I.
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington Son & Co., Philadelphia
Dietz, Schumacher & Boye, Cincinnati, O
L. S. Starrett Co., Athol, Mass.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY,

PITTSBURG, PA.

Manufacturers of Standard Systems for Electric Light and Power Distribution

IN CITIES, FACTORIES, MILLS AND MINES.

THE TESLA POLYPHASE ALTERNATING SYSTEM OF ELECTRICAL TRANSMISSION by which Power Incandescentand Arc Lighting may be Supplied from the SAME CIRCUIT.

THE WESTINGHOUSE ELECTRIC RAILWAY SYSTEM,

WHICH IS THE MOST DURABLE, ECONOMICAL AND EFFICIENT ON THE MARKET.

EW YORK, 120 Broadway. CHICAGO, New York Life Building. SAN FRANCISCO, Mills Building.
BOSTON, Exchange Building. PHILADELPHIA, Girard Building. SYRACUSE, N. Y., Bastable Building.
BUFFALO, No. 8 Erie County Bank Bldg. PITTSBURG, Westinghouse Building. TACOMA, WASH., 102 S. 10thSt.
CHARLOTTE, N. C., 25-38 College St. ST. LOUIS, American Central Building.

WESTINGHOUSE ELECTRIC COMPANY, LTD. 32 Victoria St., LONDON, S. W., ENGLAND. 32 Ave. de l'Opera, PARIS, FRANCE.

For Canada, address AHEARN & SOPER, OTTAWA, ONT.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.

Double Spindle Lathes—
Dietz, Schumacher & Boye, Cincinnati, O.

Lathes—
Lodge & Shipley Machine Tool Co., Cincinnati
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington, Son & Co., Philadelphia.
Diamond Machine Co. Providence, R. I.
Dietz, Schumacher & Boye, Cincinnati, O.

Machinists' Tools and Supplies—
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
Diamond Machine Co., Providence, R. I.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Lodge & Shipley Machine Tool Co., Cincinnati.
Dietz, Schumacher & Boye, Cincinnati, O.
Superior Machine Co., Cleveland, O.

Machine Screws—
Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

Machine Shops—
Toledo Machine & Tool Co., Toledo, O.
Atwood & M'Caffrey, Pittsburg, Pa.
The R. D. Nuttall Co., Allegheny, Pa.
The Lane & Bodley Co., Cincinnati, O.
Superior Machine Co., Cleveland, O.

Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.

Metal Bearings—
North American Metaline Co., Long Island City, N. Y.

Metal Saws—
Q. & C. Co., Chicago, Ill.

Milling Machines—
Lodge & Shipley Machine Tool Co., Cincinnati.

Mining Machinery—
Bucyrus Steam Shovel & &redge Co., South Milwaukee, Wis.
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Gates Iron Works, Chicago, Ill.

Motors—
Westinghouse Electric & Mfg. Co., Pittsburg.
General Electric Co., Schenectady, N. Y.
Card Electric Co., Mansfield, O.

Molding Sand—
Ohio Sand Co., Conneaut, O.
Newport Sand Bank Co., Newport, Ky.

Oilless Bearings—
North American Metaline Co., Long Island, City, N. Y.

Oil Burners—
W. S. Rockwell & Co., New York City.

Oil Cups—
C. H. Besly & Co., Chicago, Ill.
Diamond Machine Co., Providence, R. I.

Oil Extractors—
Jas. L. Robertson & Sons, New York.

Oil Pumps—
C. H. Besly & Co., Chicago, Ill.

Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.
Gates Iron Works, Chicago, Ill.

Packing—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Jas. L. Robertson & Sons, New York.

Paint—
Iron Clad Paint Co., Cleveland.
Jos. Dixon Crucible Co., Jersey City, N. J.

Pattern Works—
Gobeille Pattern Co., Cleveland, O.

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago.

Phosphor Bronze Castings—
Nolte Brass Co., Springfield, O.
Lorain Foundry Co., Lorain, O.

Pig Iron—
Pickands, Brown & Co., Chicago, Ill.

Pipe Covering—
C. H. Besly & Co., Chicago, Ill.

Planers—
Lodge & Shipley Machine Tool Co., Cincinnati
U. Baird Machinery Co., Pittsburg, Pa.

Plates—
Enterprise Boiler Co., Youngstown, O.

Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.

Pneumatic Appliances—
Clayton Air Compressor Works, New York.

Polishing Machines—
Diamond Machine Co., Providence, R. I.

Portable Forges—
Buffalo Forge Co., Buffalo, N. Y.
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.

Presses—
Toledo Machine & Tool Co., Toledo, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.

Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.

Pumps (Steam)—
Battle Creek Steam Pump Co., Battle Creek, Mich.
Deming Co., Salem, O.
The Edward P. Allis Co., Milwaukee, Wis.
Atwood & M'Caffrey, Pittsburg, Pa.
Henry R. Worthington, Brooklyn, N. Y.
Hughes Steam Pump Co., Cleveland, O.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

Pyrometers—
Edward Brown, Philadelphia, Pa
Uehling, Steinbart & Co., Ltd., Newark, N. J.

Radial Drills—
Dietz, Schumacher & Boye, Cincinnati, O.

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland.

Riveting Machinery—
Wm. H. Wood, Media, Pa.

Rock Drills—
Rand Drill Co., Chicago, Ill.

Rolling Mill Machinery—
The Lloyd-Booth Co., Youngstown, O.

Rolling Mill Supplies—
Atwood & M'Caffrey, Pittsburg, Pa.

Roofs—
Shiffler Bridge Co., Pittsburg.

Sand and Chill Rolls—
The Lloyd-Booth Co., Youngstown, O.
Lorain Foundry Co., Lorain, O.

Saws—
Peter Gerlach & Co., Cleveland.

Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.

Screws—
Illinois Screw Co., Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O
Chicago Screw Co., Chicago, Ill.

Shafting—
Finished Steel Co., Youngstown, O.
The Lane & Bodley Co., Cincinnati, O.

Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Toledo Machine & Tool Co., Toledo, O.
Wm. H. Wood, Media, Pa.

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland.
Ætna-Standard Iron & Steel Co., Bridgeport, O.

Special Machinery—
Toledo Machine & Tool Co., Toledo, O.
Edwin Harrington Son & Co., Philadelphia.

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago, Ill.

Steam Packing—
C. H. Besly & Co., Chicago, Ill.

Steam Hammers—
Beaudry & Co., Boston, Mass.

Steam Shovels and Dredges—
Bucyrus Steam Shovel & Dredge Co., Bucyrus, O
Marion Steam Shovel Co., Marion, O.

Steam Separators—
Jas. L. Robertson & Sons, New York.

Steam Specialties—
C. H. Besly & Co., Chicago, Ill.

Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.

Steel Castings—
Wm. Jessop & Sons, Ltd., New York, N. Y.
The Sargent Co., Chicago, Ill.

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.
Cambria Iron Co., Johnstown, Pa.

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland.

Steel Shafting—
Finished Steel Co., Youngstown, O

Stokers—
Playford Stoker Co., Cleveland, O.
Brightman Furnace Co., Cleveland, O.
Westinghouse, Church, Kerr & Co., Pittsburg, Pa.

Tanks—
S. Freeman & Sons Mfg. Co., Racine, Wis.
Enterprise Boiler Co., Youngstown, O.

Tinning Machinery—
The Lloyd-Booth Co., Youngstown, O.

Tin Plate—
Ætna-Standard Iron & Steel Co., Bridgeport, O.

Tools—
L. S. Starrett Co., Athol, Mass.

Tool Steel—
Wm. Jessop & Sons, Ltd., New York, N. Y.
C. H. Besly & Co., Chicago, Ill.

Transmission Machinery—
Link-Belt Machinery Co., Chicago, Ill.

Tube Welding—
S. Fix Sons, Cleveland.

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland.

Twist Drills—
C. H. Besly & Co., Chicago, Ill.

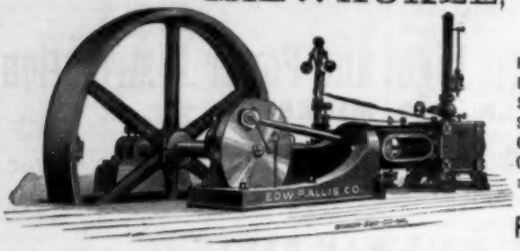
Valves—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Ventilating Fans—
Buffalo Forge Co., Buffalo, N. Y
B. F. Sturtevant Co., Boston Mass.

Wire Machinery—
John Adt & Son, New Haven Conn.

THE EDWARD P. ALLIS COMPANY

MILWAUKEE, WIS.



MANUFACTURERS OF

Blowing Engines, Hoisting Engines, Pumping Engines, Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills, Concentrators, General Mining, Milling and Smelting Machinery.

Reynolds Corliss Engines.

NEW YORK. CHICAGO. MINNEAPOLIS. DENVER. BUTTE. CITY OF MEXICO. SAN FRANCISCO PITTSBURG.

"The operator can strike hard or light blows and fast or slow."

PROMINENT USERS SAY OUR

CHAMPION POWER HAMMERS

ARE THE BEST BUILT.

FOR EVERY DESCRIPTION OF FORGING. LATE IMPROVEMENTS. SEVERAL SIZES IN STOCK.

DUPLEX FORGING PRESSES, combining Press, Shears and Punch.

BEAUDRY & CO., 162 Commercial St., Boston, Mass.

Alphabetical List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

	PAGE
Adt & Son, John	27
Ætna-Standard Iron & Steel Co	26
Aitchison, Rob't Perforated Metal Co	31
Allis & Co., Edward P	30
Almy Water Tube Boiler Co	22
Atwood & M'Caffrey	20
Bacon, Earle C	21
Baird Machinery Co	20
Battle Creek Steam Pump Co	22
*Beaudry & Co	30
Besly & Co., C. H	36
Bethlehem Iron Co	35
*Berger Mfg. Co	—
*Bertsch & Co	—
Bickford, H	36
Bourne-Fuller Co	26
Brass Founders Supply Co	32
Brightman Furnace Co	36
Brown, Edward	35
Brown Hoisting & Conveying Machine Co	35
Bucyrus Steam Shovel & Dredge Co	24
Buffalo Forge Co	1
Cahall Sales Department	1
Cambria Iron Co	26
Card Electric Co	35
Chicago Heights Land Ass'n	25
Chicago & Northwestern Ry	33
Chicago Screw Co	1
Clayton Air Compressor Works	2
Clearfield Fire Brick Co	35
Cleveland City Forge & Iron Co	1
Cleveland Electrotype Co	26
*Cleveland Galvanizing Works	—
Cleveland Rolling Mill Co	36
Clinton Iron & Steel Co	26
*Clonbrock Steam Boiler Co	—
*C. M. & St. P. Ry	—
Coffman Coke Co., W. H	26
Cole, J. Wendell	36
Deming Co	22
*Diamond Machine Co	27
Dickman & MacKenzie	1
*Dietz, Schumacher & Boye	31
Dixon, Jos. Crucible Co	33
Dover Fire Brick Co	35
Drake, Bates & Co	26
East Chicago Foundry Co	19
Emmerton, F. A	2
Enterprise Boiler Co	1
Erikson, Edward E	19
Finished Steel Co	21
*Fix Sons	—
Fleharty, J. H. & Co	2
Forster, Waterbury & Co	1
*Freeman & Sons, S	—
*Fulton Steam Boiler Wks. & Fdy. Co	—
Gates Iron Works	2
General Electric Co	24
Gerlach, Peter & Co	26
Gobeille Pattern Co	36
Hanna & Co., M. A	26
Harrington & King Perforating Co	34
Harrington, Son & Co., Edwin	27
Harrison Safety Boiler Works	18
Hartford Steam Boiler Insp. & Ins. Co	35
Hazelton Boiler Co	23
Heyl & Patterson	24
Hooven, Owens & Rentschler Co	24
Hughes Steam Pump Co	23
Hunt & Co., Robert W	2
Illinois Central R. R	27
Illinois Screw Co	1
Iron Clad Paint Co	31
Jeffrey Mfg. Co	23
Jenkins Bros	21
Jessop & Sons, Ltd., Wm	27
Jones Foundry Co., W. A	1
Junction Iron & Steel Co	2
Kellogg Weldless Tube Co	25
Lane & Bodley	32
Lake Superior Consolidated Iron Mines	26
Link-Belt Machinery Co	33
Lloyd Booth Co	34
*Lodge & Shipley Machine Tool Co	—
Lorain Foundry Co	1
Magnolia Metal Co	1
Marine Iron Works	21
Marion Steam Shovel Co	35
Moore Mfg. Co	1
†National Jeloluse Co	—
†Newport Sand Bank Co	—
Nolte Brass Co	36
Norman Co., J. J	35
North American Metaline Co	36
Norwalk Iron Works Co	2
Nuttall Co. The R. D	32
Oglebay, Norton & Co	26
†Ohio Sand Co	—
Pickands, Brown & Co	2
Pittman, C. K	2
Pollock, Wm. B. & Co	2
Playford Stoker Co	31
Prouty Co., The	2
Pullman, J. Wesley	26
Q. & C. Co	36
Rand Drill Co	2
Rippel Mfg. Co	1
Reese, Hammond & Co	36
Robertson & Sons, Jas. I	21
Rockwell & Co., W. S	33
Sargent Co., The	19
‖Sharon Fire Brick Works	1
Shiffler Bridge Co	22
Southwark Foundry & Machine Co	23
Starrett Co., L. S	1
Sterling Emery Wheel Mfg. Co	34
Stilwell-Bierce & Smith Vaile Co	2
Stevens, F. B	36
Stowe, Fuller & Co	19
Stuart Fire Brick Co	33
Sturtevant Co., B. F	2
Superior Machine Co	36
Sykes Iron Roofing Co	32
Textor, O	2
Tod, Wm. & Co	34
Toledo Machine & Tool Co	35
Uehling, Steinbart & Co	23
Union Mining Co	19
Upson Nut Co	1
Westinghouse Electric & Mfg. Co	29
Westinghouse, Church, Kerr & Co	23
Westinghouse Machine Co	27
Wood, Wm. H	22
Worthington, Henry R	22
Wellman Seaver Engineering Co	36

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	$4.50@4.75
No. 1 Bessemer hematite	4.00@4.25
Hematites No. 1 non-Bessemer	2.25@2.50
No 1. Specular, non-Bessemer	2.75@3.00

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$10 65@10 90
No. 1 Strong Foundry	11 25@11 50
No. 2 Strong Foundry	10 50@11 00
No. 1 Gray Forge, red short	9 50 9 75
No. 2 Gray Forge, neutral	... ... 9 90
No. 1 American Scotch	... ... 11 65
No. 2 American Scotch	... ... 11 15
Lake Superior Charcoal	... ... 13 50
PITTSBURG:	
No. 1 Foundry	$11 25@11 50
No. 2 Foundry	10 75@11 00
Gray Forge	9 50@9 65
White and Mottled	... ... 9 50
Warm Blast Charcoal	15 00@16 00
Cold Blast Charcoal	... ... 20 00
Bessemer	10 50@10 50
CHICAGO:	
Lake Superior Charcoal	$13 50@$14 00
Local Coke Foundry No. 1	11 50@12 00
Local Coke Foundry No. 2	11 00@11 50
Local Coke Foundry No. 3	10 75@11 00
Local Scotch Foundry No. 1	11 50@12 00
Local Scotch Foundry No. 2	11 00@11 50
Local Scotch Foundry No. 3	10 75@11 00
Southern Coke No. 1	11 15@11 40
Southern Coke No. 2	10 65@11 15
Southern Coke No. 3	10 40@10 65
Southern No. 1 Soft	10 90@11 40
Southern No. 2 Soft	10 65@10 90
Southern Silveries	11 40@11 65
Jackson Co. Silveries	14 00@16 00
Ohio Silveries No. 1	15 00@15 50
Ohio Silveries No. 2	14 50@15 00
Ohio Strong Softeners	14 00@14 25
Alabama Car Wheel	16 00@16 50
Malleable Bessemer	12 00@12 25
Coke Bessemer	13 00@13 50
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$10 50@10 75
Southern Coke No. 2 and No. 1 Soft	10 25@10 50
Hanging Rock Coke, No 1	12 50@13 50
Hanging Rock Charcoal No. 1, Fdy	15 00@16 00
Tennessee Charcoal No 1	13 00@14 00
Jackson County Silvery No 1	13 50@14 00
Southern Coke, Gray Forge	... ... 9 25
" " Mottled	... ... 9 25
Standard Alabama Car Wheel	14 75@15 50
Tennessee " "	13 50@14 50
Lake Superior " "	14 75@15 25
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	$... ...$12 00
No. 2 Foundry Strong Coke Iron Lake Superior Ore	11 75@12 00
Ohio Strong Softener No. 1	... ... 12 25
Jackson Co. Silvery No. 1	... ... 14 25
Lake Superior Charcoal	... ... 14 00
Southern Soft No. 1	... ... 12 00
Hanging Rock Charcoal	... ... 17 00
ST. LOUIS (reported by Rogers, Brown & Meacham):	
Southern Coke No 1	$... ...$11 00
Southern Coke No. 2	... ... 10 50
Southern Coke No. 3	... ... 10 00
Southern Gray Forge	... ... 9 75
Southern Charcoal No. 1	... ... 15 00
Missouri Charcoal No. 1	14 00@14 00
Ohio Softeners	... ... 15 50
Lake Superior Car Wheel	... ... 15 20
Southern Car Wheel	... ... 15 25

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons
Old iron rails	$14 50
Old steel rails	10 50
Old car wheels	10 00
	Net Tons
No. 1 R. R. wrought scrap	$10 50
Mill scrap	8 00
No. 1 Machine cast scrap	8 50
Iron axles	14 50
Axle turnings	7 50
Wrought turnings (free from cast)	6 75
Cast borings	5 00
Uncut wrought iron boilers	4 00
Steel boiler plates	8 00
Grate bars	5 00
Pipes and flues (clean)	8 00
Tank iron	8 00
Hoop and band iron	6 00
Sheet iron	5 00
Wrought drillings	6 00
Malleable iron	9 00

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. Cleveland)	1.65c
Angles	1.25c
Tees	1.35c
Universal Plates	1.20@1.25c
Sheared Plates	1.30c

MERCHANT IRON AND STEEL.

[Less than car-lots, Cleveland.]

Rounds and Squares.—Bar Iron.

1 to 1⅜	1.20 Base
2 to 2⅞	.20 extra
3 to 3½	.50 "
3⅝ to 4	.80 "
4⅛ to 4½	1.00 "
4⅝ to 5	1.30 "
5⅛ to 6	1.80 "
6⅛ to 6½	2.20 "

PERFORATED METALS

OF ALL KINDS FOR

MILLING, MINING AND AGRICULTURAL MACHINERY.

Perforated Iron, Steel, Copper, Brass, Tin, Zinc, Lead, Etc., to Order.
Large and Varied Assortment of Sizes. Correspondence Solicited.

THE ROBERT AITCHISON PERFORATED METAL CO.,

Office, Room 510, 265 to 269 Dearborn St., CHICAGO, ILL. Works, So. Chicago.

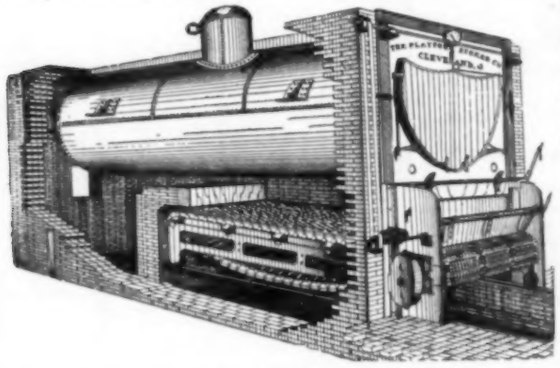
LATHES.

ENGINE LATHES, 14 in. to 30 in.
24" x 42", 26" x 44", } DOUBLE SPINDLE.
RADIAL DRILLS, 52 in. to 120 in.

Dietz, Schumacher & Boye, Cincinnati, O

Persistence in Advertising

Is one of the requisites of satisfactory results. In the expansion of business which is confidently expected in the United States in the very near future, advertisers who have made themselves regularly prominent in the past two years will be first to reap the rewards of persistent publicity.



The Playford Mechanical Stoker

Guaranteed to

Abolish smoke, to increase boiler capacity and to save fuel.

For information, address,

The Playford Stoker Co.,

No. 61 Case Library Bldg.,

CLEVELAND, O.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.

CLEVELAND OHIO.

ORDER DIRECT FROM THE

Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

6⅝ to 7¼	2.50 extra.
⅜ to ⅝	.10 "
9-16 to 11-16	.20 "
⅝ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13-32	.50 "
5-16 to 11-32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1½ to 4 x ⅜ to 1	1.20 Base.
4¼ to 6 x ⅜ to 1	.10 extra.
6¼ to 8 x ⅜ to 1	.60 "
8¼ to 10 x ⅜ to 1	.80 "
1⅜ to 4 x 1 1-16 to 1½	.30 "
4¼ to 6 x 1 1-16 to 1½	.40 "
6¼ to 8 x 1 1-16 to 1½	.60 "
8¼ to 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1⅝ to 2	.50 "
4¼ to 6 x 1⅝ to 2	.60 "
6¼ to 8 x 1⅝ to 2	.80 "
8¼ to 10 x 1⅝ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1⅜ to 1⅜ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.20 "
¾ to 15-16 x ⅜ to ⅝	.40 "
⅝ to 11-16 x ⅜ to ⅝	.50 "
⅛ to 9-16 x ⅜ to ⅝	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1½ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30 "
¾ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
⅛ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5 16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra.
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1½ to 4 x No. 9 to 3-16	.40 "
1¾ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos 10, 11 and 12	1.10 "
7-16 to ½ x No. 9 to 3-16	1.30 "
7-16 to ½ x Nos. 10, 11 and 12	1.40 "
⅜ x No. 9 to 3-16	1.50 "
⅜ x Nos. 10, 11 and 12	1.60 "

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in. .70

Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅞ to 1½	.40 extra.
¾ to 13-16	.50 "
⅝ to 11-16	.60 "
½ to 9-16	.80 "
⅜ to 7-16	1.10 "
½ to 9-16 x 3-16	1.00 "
⅝ to 11-16 x ⅛	1.20 "

Half Oval and Half Round.

2¼ to 3	.60 extra.
⅞ to 2	.50 "
¾ to 13-16	.70 "
⅝ to 11-16	90 "
½ to 9-16	1.20 "
⅜ to 7-16	2 50 "
5-16	3.50 "
¼	4 50 "

Half Ovals less thau ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes .1 c extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

Width in Inches.	English Standard Gauge.	
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16 "	1.90 Base.
		Extras.
1½ to 6,	" 10, 11, 12 or 5/16"	.05 per 100 lbs.
1 to 1⅜,	" 7, 8, 9 or 3-16"	.10 "
1 to 1⅜,	" 10, 11, 12 or 5/16"	.15 "
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20 "
13-16 and ⅞,	" 10, 11, 12 or 5/16"	.25 "
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30 "
11-16 and ¾,	" 10, 11, 12 or 5/16"	.35 "
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40 "
9-16 and ⅝,	" 10 11, 12 or 5/16"	.45 "
½,	Nos. 7, 8 9 or 3-16"	.55 "
½,	" 10, 11, 12 or 5/16"	.60 "
7-16	" 7, 8, 9 or 3-16"	.75 "
7-19	" 10, 11, 12 or 5/16"	.85 "
⅜,	" 7, 8, 9 or 3-16"	.95 "
⅜,	" 10, 11, 12 or 5/16"	1.05 "

Iron and Steel Hoops.

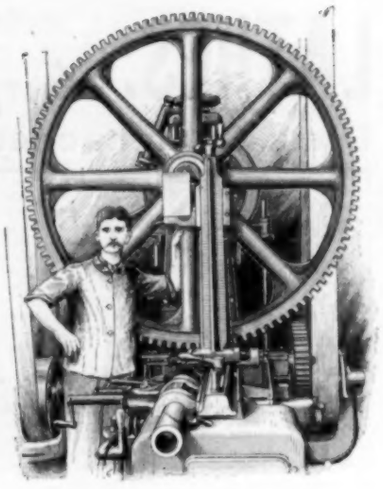
Width in Inches.	English Standard Gauge.	
1 7-16 to 3	Nos. 13, 14, 15 and 16	1.60 Base
		Extras
1 7-16 to 2,	" 17, 18, and 19	.05 per 100 lbs
1 7-16 to 2,	" 20	.10 "
1 7-16 to 2,	" 21	.15 "
1 7-16 to 1¾,	" 22	.25 "
1 ⅝ to 1¾,	" 13, 14 and 15	.05 "
1⅝ to 1¾	" 16, 17 and 18	.10 "

R. D. NUTTALL CO.,

99 BOQUET STREET, ALLECHENY, PA.

THE SUPERIORITY OF

Cut Teeth Over Cast Teeth



IN GEARS FOR . . . .

Rolling Mill and Bridge Work

Has been fully demonstrated, both in the life of the Gear and greater efficiency.

CORRESPOND WITH US BEFORE ORDERING AGAIN.

THE BRASS FOUNDERS' SUPPLY CO.

FURNACES, FLASKS, FOUNDRY Supplies and Specialties.

Send for our Catalogue and look at the Ribbed Flask.

R. M. BARNETT. 20-34 Prospect St., **NEWARK, N. J.** J. S. MUNDY.

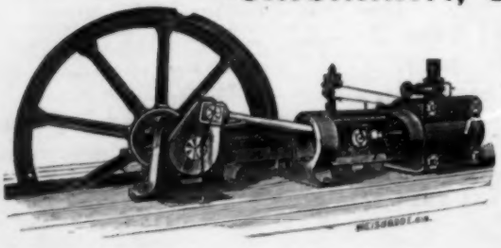
WORLD'S FAIR AWARD.

We are the only Steel Roofing Co. awarded Medal and Diploma for **PATENT CAP ROOFING** at World's Columbian Exposition. We are also large manufacturers of all styles of **METAL ROOFING, SIDING, CEILING, ETC.** Send for Catalogue and Price List. Mention this paper.

SYKES IRON & STEEL ROOFING CO., Chicago and Niles, O.

THE LANE & BODLEY CO.,

CINCINNATI, OHIO.



Engines,

ALL SIZES.

Simple and Compound.

Shafting, Hangers, Pulleys.

Belt Elevators, Saw Mills.

1¼ to 1⅜,	"	19 and 20	.15 per 100 lbs
1⅜ to 1⅜,	"	21	.20 "
1⅜ to 1⅜,	"	22	.30 "
15-16 and 1,	"	13, 14 and 15	.10 "
15-16 and 1	"	16, 17 and 18	.15 "
15 16 and 1,	"	19 and 20	.20 "
15-16 and 1,	"	21	.25 "
15-16 and 1,	"	22	.35 "
⅞,	Nos.	13, 14 and 15	.20 "
⅞,	"	16, 17 and 18	.25 "
⅞,	"	19 and 20	.30 "
⅞,	"	21	.35 "
⅞,	"	22	.45 "
¾ and 13-16	Nos.	13, 14 and 15	.30 "
¾ and 13-16	"	16, 17 and 18	.35 "
¾ and 13-16	"	19 and 20	.40 "
¾ and 13-16	"	21	.45 "
¾ and 13-16	"	22	.50 "
¾ and 13-16	"	23	.60 "
11-16,	Nos.	13, 14 and 15	.35 "
11 16,	"	16, 17 and 18	.40 "
11-16,	"	19 and 20	.50 "
11-16,	"	21	.60 "
11-16,	"	22	.70 "
11-16,	"	23	.80 "
⅝,	Nos.	13, 14 and 15	.40 "
⅝,	"	16, 17 and 18	.45 "
⅝,	"	19 and 20	.55 "
⅝,	"	21	.65 "
⅝,	"	22	.75 "
⅝,	"	23	.85 "
9 16,	"	13, 14 and 15	.45 "
9-16,	"	16, 17 and 18	.50 "
9-16,	"	19 and 20	.60 "
9-16,	"	21	.70 "
9-16,	"	22	.80 "
9-16,	"	23	.90 "
½,	"	13, 14 and 15	.55 "
½,	"	16, 17 and 18	.60 "
½,	"	19 and 20	.70 "
½,	"	21	.80 "
½,	"	22	.90 "
½,	"	23	1.00 "
7-16,	"	13, 14 and 15	.80 "
7-16,	"	16, 17 and 18	.90 "
7-16,	"	19 and 20	1.00 "
7-16,	"	13, 14 and 15	1.00 "
⅜,	"	16, 17 and 18	1.10 "
⅜,	"	19 and 20	1.20 "

Sheet Iron.

No. 10	1 50
No. 12	1 70
No. 14	1 60
No. 15-17	1 75
No. 18	1 85
No. 20	2 00
No. 22-24	2 10
No. 25-26	2 20
No. 27	2 30

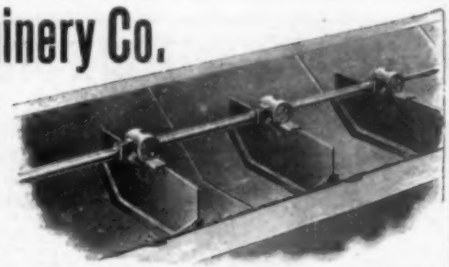
English Tool Steel.

Jessop's	15½c
Hobson's " Best "	15½c
" " Choice "	35c

The Link-Belt Machinery Co.

ENGINEERS. FOUNDERS. MACHINISTS.

CHICAGO, U. S. A.



Modern Methods as applied to the handling of Iron Ore, Coal, Raw and Manufactured Products.

Manila Rope, Power Transmissions, Shafting, Pulleys, Shaft Bearings, Gearing, Friction Clutches, etc.

IMPROVED DUPLEX SYSTEM
- - - FOR - - -
BURNING FUEL OIL.

Heats and cleans the oil and delivers it to the fires under high and uniform pressure.

Entirely automatic, most scientific, sensible and economical method of burning oil in existence. If you are operating a Steel Works, Brass or Copper Rolling Mill, Malleable Iron Works, Bolt and Nut Works, Bicycle Works, or do Annealing, Forging, Brazing, Tempering, Japanning, Enameling, Case Hardening, you can use this machine to your advantage.

WE BUILD FURNACES OF ALL KINDS. SATISFACTION GUARANTEED.

W. S. ROCKWELL & CO.,

26 CORTLANDT STREET, NEW YORK.

SUBSCRIBE FOR THE IRON TRADE REVIEW, $3 PER YEAR.

DIXON'S PERFECT LUBRICATING GRAPHITE.

The most Marvelous Lubricant Known.
Used Dry, or Mixed with Water, Oil or Grease

NOT AFFECTED BY HEAT, COLD, STEAM OR ACIDS.

An Interesting and Instructive Pamphlet will be sent Free of Charge.

JOS. DIXON CRUCIBLE CO. Jersey City, N. J.

STUART FIRE BRICK CO.

MANUFACTURERS OF

Silica Brick

For Open-Hearth, Basic and Acid Steel Furnaces, Glass and Copper Tank Furnaces. Extra Shapes MADE TO ORDER.

Office, Room 21, Conestoga Bldg., Cor. Wood and Water Sts., PITTSBURG, PA.

The Chicago & North-Western Railway

REACHING with its 7,966 miles of road the famous Water Powers, Coal Fields, Iron Ore Ranges, Hard and and Soft Lumber Districts located in Illinois, Wisconsin, Michigan, Iowa, Minnesota, South Dakota, North Dakota, Nebraska and Wyoming, and by traffic arrangements with other railways, 7,350 stations located on 41,000 miles of railroad (one-ninth of the entire railroad mileage of the world, and one-fourth of the railroad mileage of the United States), has on its line more industries than any other western railroad.

Manufacturers contemplating moving or establishing branch factories in the West are requested to inquire what we can offer them before locating elsewhere.

M. HUGHITT,
General Freight Agent,
CHICAGO.

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 35
Shell	1 45
Flange	1 55
Marine Flange	1 60
Fire Box	2 05

Above includes plates 90 inches wide.

90 to 96 in. wide	¼c. lb. extra
96 to 100 in. wide	1c. "
100 to 104 in. wide	1¼c. "
104 to 106 in. wide	special.

Flats. cts. lbs.

2 to 9-16 in. wide by 2 to ⅝ thick .08

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 40
Open-hearth Tire	"	1 45
Open-hearth Spring	"	1 80
Sleigh Shoe	"	1 45
Toe Calk	"	1 90
Cutter Shoes, tapered and bent	"	1 60

American Cast Tool Steel.

ROUND, SQUARE, AND OCTAGON. cts lbs.

1 to 2 in. inclusive	08
9-16 to ⅝ in. "	08
7-16 to ⅜ and 2⅛ to 3 in	09
3⅛ to 4 in	09½
⅝ to 11-16 and 4⅛	10
⅛ to 6 in	10½
¾ to 9-32 and 6⅛ to 7 in	11
1 in	13

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 10
Bridge ½, ⅝, 11-16 and ¾ inch diam	2 55

Wrought Pipe and Boiler Tubes.

Lap weld black	base,	four 10s	62
Butt " "	"	four 10s	62½
Lap " galv.	"	four 10s	52½
Butt " "	"	four 10s	50
Boiler tubes 2¼" and smaller			70
Boiler tubes 2½" and larger			75
Casting screw and socket joint			dis. 52½
Casing inserted joint			dis. 47½

MACHINERY SUPPLY MARKET.

[From Store, Cleveland.]

Anvils.

American	₩ lb 9@10
Wright's	₩ lb 12

Bellows.

Blacksmiths'	Hill's dis 40
	Bullock's dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70 & 10
" " " extra	dis 60&10
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 50
Shultz Raw Hide Leather Belting, single,	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 80
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 33⅓
Horton's Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 45
Sweetland "	dis 40
Almond Drill	dis 40
Morse "	dis 20
Skinner's Combination Lathe	dis 40&15
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 50

Cutters and Reamers.

Cleveland	dis 10@5
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 10 to 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	₩ 3½
Iron, steel points	₩ lb 3

Drill and Drill Sockets.

Twist Drills	
Morse Taper & Straight Shank to 1⅜"	dis 50 & 10 to 60
Morse Taper and Straight Shank Larger than 1⅜"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 60&60&5
Cleveland " "	dis 60&60&5

Emery.

	No. 4 to No. 54 46 gr.	150 gr.	Flour F. P.	C. F.
Kegs, ₩ lb	4½c	5 c	2¾c	
½ kegs ₩ lb	4¾c	5¼c	2¾c	
¼ kegs ₩ lb	5 c	5½c	3 c	
10 lb cans, 10 in case	6 c	6½c	5 c	
10 lb cans less than 10	10 c	10 c	7½c	

Perforated Filter Press Plates.

THE HARRINGTON & KING PERFORATING CO. CHICAGO.

BRONZE SCREEN PLATES To withstand action of ACIDULATED WATERS.

PERFORATORS OF STEEL, IRON, COPPER, ZINC, BRASS AND TIN.

For use in GRAIN CLEANING AND MINING MACHINERY, WOOLEN, COTTON, PAPER AND PULP MILLS, RICE, FLOUR AND COTTON SEED OIL MILLS, SUGAR AND MALT HOUSES, DISTILLERIES, FILTER PRESSES, STONE, COAL, AND ORE SCREENS, BRICK AND TILE WORKS, FILTERS, SPARK ARRESTERS, GAS AND WATER WORKS, OIL, GAS AND VAPOR STOVES, COFFEE MACHINERY, ETC.

STANDARD SIZES PERFORATED TIN AND BRASS ALWAYS IN STOCK.

Main Office and Works, 226 North Union Street, Chicago, Ill., U. S. A. Eastern Office, No. 284 Pearl St., New York.

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
H. H. Barton	dis 50@50&5

Emery Wheels.

Detroit	dis 60@70
Norton's	dis 60@70
Grant	dis 60@70
Sterling	dis 60@70
Celluloid	dis 10&33⅓
Northampton	dis 50
Crystal	dis 65@70
Vitrified	dis 60@70
Vulcanite	dis 60&10
Hamden	dis 60&10@70
Cyclone	dis 60@60&10

Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F.	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 60@70
Western	dis 70
Stub's	dis 25
Grobet's	dis 30
Reynolds Bros.' Hand Cut	dis 50
Industry File Works Hand Cut	dis 50

Hammers.

P. S. W	dis 40
Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs	10c
" " " " over 5 lbs	8c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	15⅓	11⅓	8⅓	6	5¾	5¾	
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ¶ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

Standard Penny Nails, ¶ keg, base.
{ Car lots $1.70
{ Less than car lots $1.80

Oilers.

Zinc and Tin	dis 60
Brass and Copper	dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ¶ doz	dis 10@10&10

Picks.

Railroads, 5 to 6 lbs	$12 dis 60
" 6 to 7 lbs	$13 dis 60

Rivets.

Iron, Thousand, list November 1, 1894	dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894	dis 60@65
Copper	dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

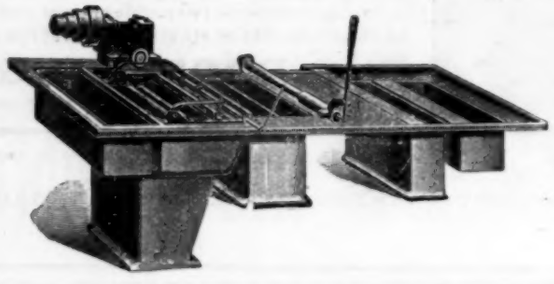
Wire.

New List, Apr. 9, 1894

Brass	dis 35
Copper	dis 35
Bright and annealed, Nos. 6@18	dis 70&10&5
" " Nos. 19@26	dis 75@75&5
" " Nos. 27@36	dis 75&10&5
Coppered Nos. 0 to 18, market list	dis 70@70&5
Galvanized Nos. 0 to 18 " "	dis65&5
Tinned market Nos. 0 to 18	dis 67½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ¶ lb dis 30

THE LLOYD-BOOTH CO., YOUNGSTOWN, OHIO.

Tinning MACHINERY.

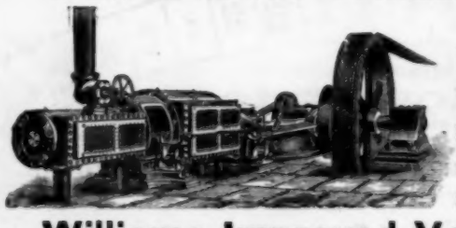


Rolling Mills, Sand and Chill ROLLS.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

The Porter-Hamilton Engine



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

Williams Improved Vertical Engines

For Direct Electrical and all High Class Work.

39-41 Cortland St., N. Y. E. F. WILLIAMS.

Park Building, Pittsburg, SEWARD S. BABBITT.

STERLING EMERY WHEEL MFG. CO. TIFFIN, O.

CORRESPONDENCE SOLICITED

AGENTS:

Chicago Branch, 59 So. Canal St.
The Geo. Worthington Co., Cleveland:
Somers, Fitler & Clarke, Pittsburg

BELT DRIVEN DIRECT DRIVEN

DYNAMOS AND MOTORS

SLOW SPEED HIGH GRADE

THE CARD ELECTRIC CO.

MANSFIELD, OHIO. U. S. A.

If you are thinking of enlarging your mill, foundry or machine shop, or of purchasing machinery of any kind, send us a line giving character of machinery needed. We can put you in communication with manufacturers from whom you can buy advantageously.

J. M. ALLEN, President.

WM. B. FRANKLIN, Vice-President.

F. B. ALLEN, Second Vice-President.

J. B. PIERCE, Secretary and Treas.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

HARTFORD, CONN.

BURWELL & BRIGGS, General Agents, 32 Wilshire Bldg., Cleveland, O.

C. A. BURWELL, Chief Inspector, 32 Wilshire Bldg., Cleveland, O.

J. E. WOLCOTT, Special Agent, 96 4th Avenue, Pittsburgh Pa.

PYROMETERS

Edward Brown,

ESTABLISHED 1860.

311 WALNUT St., PHILADELPHIA.

Manufacturer and Patentee

OF THE

Hot Blast (or Graphite) Pyrometer.—The only stationary Pyrometer now in use durable over 700 degrees.

The Standard Portable Pyrometer—For Blast Furnaces.

Mercury Revolution Indicator.—Centennial Exhibition Medal. Accurate for all time.

Annealing Oven Pyrometer—to 3,000 degrees—of 1893.

Tin-plating Pyrometer—of 1894.

Mercury and Steam Gauges.

THE BETHLEHEM IRON CO.,

Principal Office and Works,

SOUTH BETHLEHEM, PA.

STEEL RAILS.

BILLETS AND MUCK BAR,

STEEL FORGINGS.

HOLLOW SHAFTING, CRANKS, ROLLS, GUNS AND ARMOR.

Rough, Machined or Finished, Fluid Compressed, Hydraulic Forged.

NEW YORK OFFICE, 100 BROADWAY. PHILADELPHIA OFFICE, 421 CHESTNUT ST

CHICAGO OFFICE, MARQUETTE BUILDING.

No. 3 Power Press

TOLEDO MACHINE & TOOL CO.,

501-505 Superior St., Toledo Ohio.

We manufacture

Power Punches. Forging Presses.
Power Presses. Trimming Presses.
Straight Sided Double Pitman Presses.
Drop Presses.
Embossing Presses. Automatic Feed Presses.
Stamping Presses. Power Slitting Machines.
Riveting Machines. Power Shears.

Special and Automatic Machinery Dies for all classes of work in sheet metals.

Write for catalogue and prices.

No. 25 Power Press.

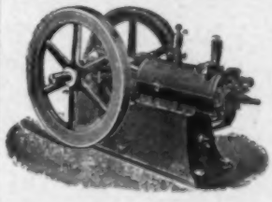
THE "CLEARFIELD" FIRE BRICK

MANUFACTURED BY

THE CLEARFIELD FIRE BRICK CO., Limited,

Office and Works at CLEARFIELD, PA.

929 Liberty Street, Pittsburg, Pa., John Richardson, Agent.



THE CHICAGO GAS and GASOLINE ENGINE

The simplest gas and gasoline engine on the market. Has no equal for absolute, steady speed and durability. It is a dwarf in size and a Samson in strength.

Catalogue sent on application.

MANUFACTURED BY

J. J. NORMAN CO., 60 S. Clinton St., Chicago, Ill.

The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year **$3.00.**

THE BROWN HOISTING AND CONVEYING MACHINE CO. CLEVELAND, O.

MACHINERY FOR HANDLING COAL AND ORE.

CRANES

NEW YORK, HAVEMEYER BLDG.
PITTSBURG, CARNEGIE BLDG.
CHICAGO, MARQUETTE BLDG.

KING'S SIX TON ELECTRIC CRANE

Can be furnished at low cost.

Write for full information to the MARION STEAM SHOVEL CO Marion, Ohio.

FIRE

DOVER FIRE BRICK CO.,

MANUFACTURERS OF

Furnace, Mill and Special Shape Fire Brick.

Office, 44 Mercantile Bank Bldg., CLEVELAND, OHIO.

BRICK

THE

'ELLMAN,

SEAVER

NGINEERING CO.,

w England Bldg.,

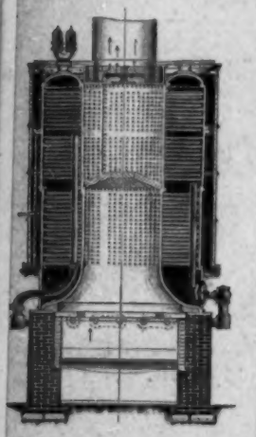
LEVELAND, O.

ENGINEERS

AND

CONTRACTORS.

e make a specialty of the de- and construction of STEEL RKS, ROLLING MILLS STEEL WORKING MA- INERY. Metallurgical naces of all kinds. Steel dings for all purposes. Spe- Electric and other power velling Cranes and Gantries.



'e have undertaken to exploit Berry Safety Boiler.

WHY?

ecause after watching it in the dest kind of service for two rs, we are fully convinced that embodies in its construction e good points than any other ler ever built.

t will be manufactured at the rks of John Mohr & Sons, icago, which fact alone is a rantee that both material and rkmanship will be the best t money can buy.

ome of the good points of the rry Boiler are the following:

It gives uniformly DRY STEAM.

It is SAFE and durable.

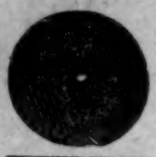
Is economical in first cost.

Is economical in maintenance.

gives the greatest horse-power per square foot of floor space occupied.

Send for our descriptive pamphlet, which will tell you the whole story.

THE HART OR DETROIT



Emery Corundum Wheels and Machinery.

Write to J. WENDELL COLE, M. E.,

District Manager, No. 911 Chicago Opera House Block, Chicago, Ill., or Box 84, Columbus, O

N. B.—Also Agent for WM. SELLERS & CO.'s SPECIAL TOOL GRINDER and TWIST DRILL GRINDER WITH POINTER, for Pennsylvania, Ohio, Indiana, Illinois and Wisconsin.

AUTOMATIC GEAR CUTTERS

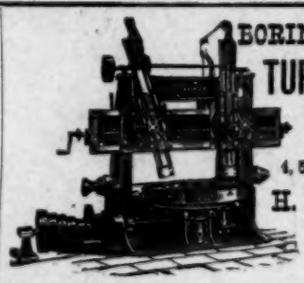
GEAR CUTTING OF ALL KINDS.

SUPERIOR MACHINE CO., CLEVELAND, O.

Don't Waste Money in Your Pattern Shop.

THE GOBEILLE PATTERN CO., Cleveland.

When you write to firms advertised in our columns, please mention the fact that you took their address from our paper. They will thank you for it.



BORING AND TURNING MILLS.

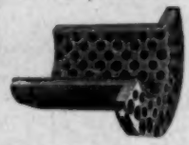
4, 5 & 6 Ft. Swing

H. Bickford

Lakeport, N. H

Send for Photograph and Low Price.

OILLESS BEARINGS



For Loose Pulleys and other bearings. Perfectly clean. No cutting or danger of fire from overheating. Send for Loose Pulley circular.

No. American Metaline Co.

40 to 48 Third Street, Long Island City, N. Y.

F. B. Stevens

90 Griswold St., Detroit, Mich.

Fire Brick, Fire Clay and Foundry Supplies.

FLAT SURFACES
SEND FOR CATALOGUE
GARDNER GRINDER WILL DO FROM TWO TO TEN TIMES AS MUCH WORK AS A SOLID WHEEL
CH BESLY & CO. CHICAGO ILL U.S.A.

The A B C of Iron

A book for foundrymen. It is issued in cloth binding, and gives much valuable matter on how to reduce cost of mixtures, and on grading and numbering of pig iron.

FORMER PRICE $2.00

NOW -:- $1.00.

ORDER OF

THE IRON TRADE REVIEW CO.,

27 Vincent St., CLEVELAND.

THE 1896 EDITION

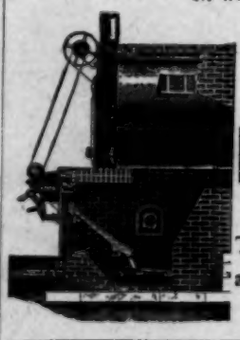
OF THE

Iron and Steel Directory

Will be sent postpaid by *The Iron Trade Review* at $6.

Is a thorough revision of the list of blast furnaces, rolling mills, Bessemer and Open-Hearth steel works, plate and sheet mills, nail mills, tin plate mills, malleable, cast iron pipe and wrought pipe works, car wheel and locomotive works.

N. W. TAYLOR. H. H. CAMPBELL.



Brightman Furnace Co.

648 Broadway, CLEVELAND, O.

SOLE MANUFACTURERS OF THE

Brightman Mechanical Stoker

FOR STEAM BOILERS.

THE MOST ECONOMICAL IN FUEL

and the Best Device in the World for Preventing Smoke.

Send for Catalogue "A."

BRASS CASTINGS for all purposes. PHOSPHOR BRONZE for Machine Box Bearings, etc. Special Finished Brass Work made to order.

NOLTE BRASS COMPANY,

65 and 67 E. Washington St., Springfield, Ohio.

"HAMMOND" AND "ACME"

HIGH GRADE FIRE BRICK

ARE THE BEST.

MANUFACTURED BY

Reese, Hammond & Co.,

BOLIVAR, PA.

Specialties: Tile, Grate Settings, Stove Linings and Difficult Shapes to order, Cupola Blocks.

BEST ANTI-FRICTION METAL